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American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

APRIL 26, 1954

How to understand heat-treatment

a special report

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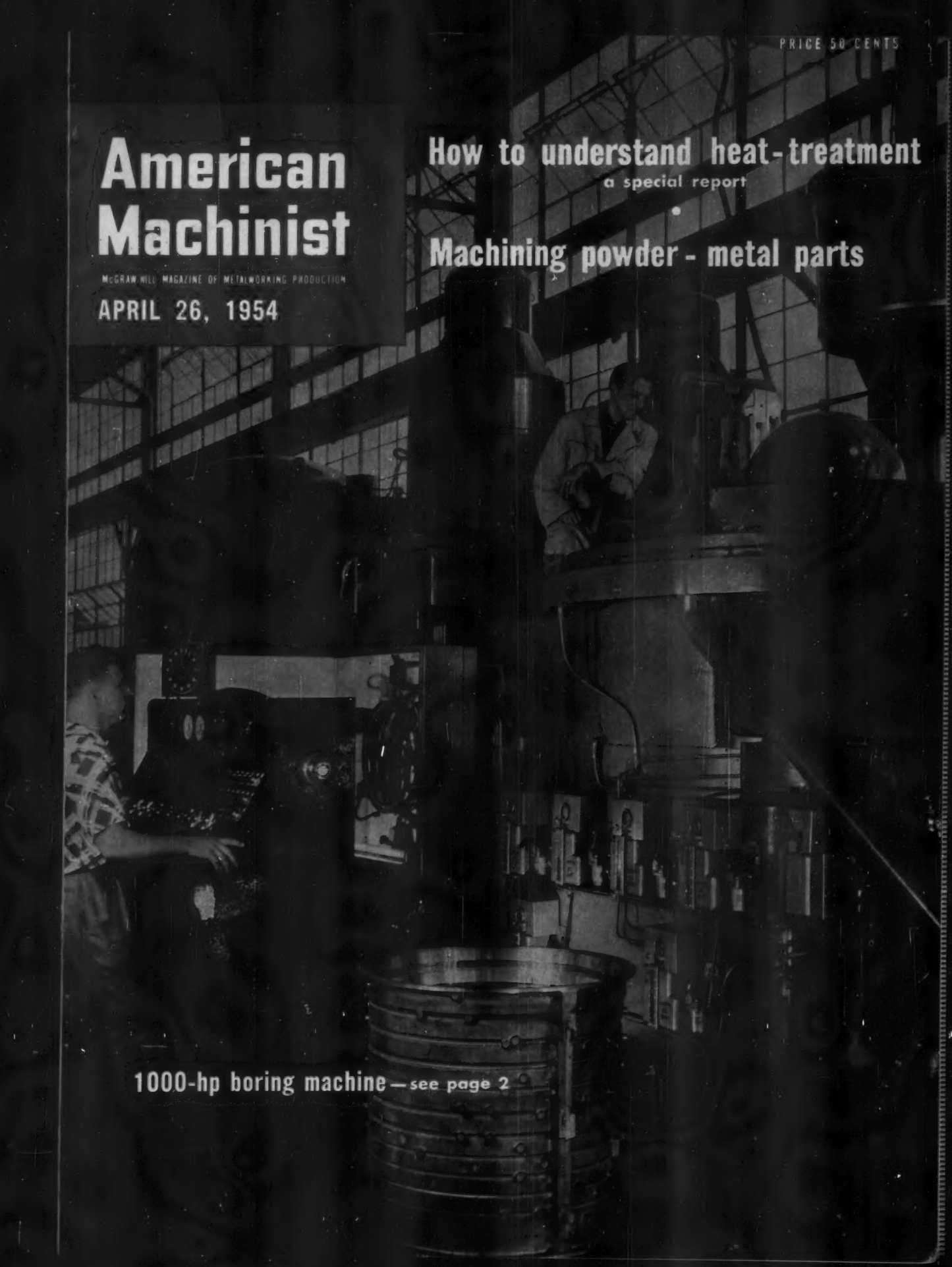
Machining powder-metal parts



1000-hp boring machine—see page 2

. . . Seen any lamplighters lately?

THE lamplighter's job seemed pretty secure . . . until someone discovered how to light a lamp without a flame; turn it out at the flick of a switch. Then the lamplighter disappeared — but a whole new industry was born.

For competition is at work everywhere, constantly directing the shape of things to come. Products that are better or less costly forge ahead — others are left behind.

Today, with competition rising to a normal, healthy pitch, manufacturers everywhere are seeking new ways to improve production and cut costs. That's where we at Heald can help you. In the vital matter of precision finishing, new Heald machines and advanced Heald engineering can often effect substantial savings—improve production speed and product quality too! Ask your Heald representative about the latest developments in automation, simultaneous and progressive borizing, improved grinding and loading methods.

Competition is wonderful if you're *ahead* of it. Our business is to help keep you there. That's why IT PAYS TO COME TO HEALD.

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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chips

MOST POWERFUL . . . The vertical boring mill, called the "Jet Bore," pictured on our cover and made for the Air Force by Hautau Engrg Co, Ferndale, Mich, is probably the most-powerful machine tool thus far built. It is designed to finish all interior surfaces of an aluminum-alloy stator casing (foreground) for jet engines. This 250-lb, 2-piece casting will be completed in 6 min instead of the one hour required by six standard vertical borers which are replaced. 100 lb of chips will be removed by 55 carbide tools on four bars (under the red dome at upper right), as well as by tools on two upper (red and yellow, at top) and two lower slides. Tools are fed out in sequence while the housing rotates at 2200 sfpm. A thrustless spindle is a feature. The machine, which weighs 60 tons, includes an electric pot (rear) for melting Cerro alloy with which the workpiece is held in the pot chuck (5500 lb loaded) at upper right.

POWDER MACHINING . . . Sharp carbide tools, correct angles, and proper speeds are the answer in powder-metal machining according to Messrs Langhammer and Glick of Chrysler-Amplex, who wrote this issue's lead article. They show and discuss sample pieces, and from them draw general recommendations for avoiding trouble.

CHIP BREAKERS . . . The NMTBA is now releasing the data from its Cornell studies on chip-breaking. Some months ago, we asked the man who did the work to prepare a Special Report for you about it. It is the first of two Special Reports in this issue. Don't miss Erik Henriksen's suggestions, based on research for the NMTOA at Cornell.

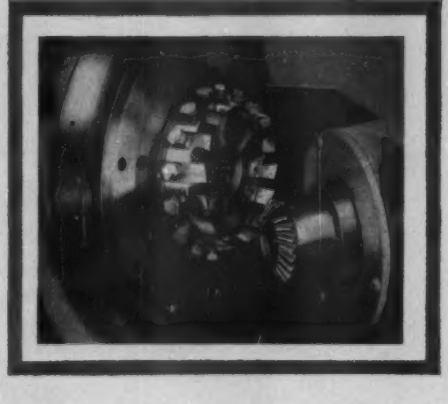
HEAT TREATING—BASICALLY . . . Samuel Storchheim, familiar to many of you, is back again, this time with a 10-page Special Report on Heat-Treating Fundamentals. It gives you basic metallurgy of the process, in terms any of us can understand.

TOOLING . . . We have three tooling articles in this issue, one on shells, one on radials, and one on welding. Stephen F Pasternak, chief engineer of Peerless of America, explains how a cam feed speeds undercutting in machining a 75-mm shell. Air cylinders move carriage and cross-slide of a Type A Hepburn lathe, the cross-slide feed being speeded by a lever-operated cam. . . . Ben Schwarz of DeLaval gives us further information on trunnion fixtures for radials. These simplify jig-making and setup, utilize drill plates. . . . A M Troyer and Dan Lorain, Jr, of Westinghouse, describe a new head that permits automatic welding without costly, time-consuming fitup. It compensates for tacks, bumps and hollows automatically. . . . Then there's another instalment of Stanley Cope's series on draw dies, and a series of examples of air feeds applied to various shop operations.

COMING . . . *AM* for May 10 will have a super Special Report 20 pages long, giving a roundup on grinding non-cylindrical shapes. There are articles on automatic silver brazing, on dynamometers, automatic brushing, centerless grinding of plastics, and details of assembly of complex business machines. Our cover shows the machining of a rear-axle banjo.

STRESS ANALYST . . . Erik K Henriksen, who authored our article on balanced chip-breaker design, is Professor of Mechanical Engineering, University of Missouri, in charge of the machine-tool laboratory there. He was born a Dane, but is now taking out citizenship papers. Past experience has been in locomotive and diesel-engine design, in Denmark; several engineering jobs in Europe; a professorship at the Royal Danish Technical University; and as professor-in-charge, materials-processing laboratory, Cornell University. He's an experienced author, too, having written a number of engineering textbooks, reference books, and research reports.

NEW NO. 106 HYPOID GENERATOR



This tractor belt pulley drive gear, 25 teeth, 7 D P, 11/16" face, 8620 steel, is completed in one operation at 14.6 sec. per tooth, 5.8 min. floor-to-floor time.

. . . For cutting spiral bevel, ZEROL® bevel, and hypoid gears up to 4 D P, 8½" diameter, 1¼" face

This versatile machine is ideal for small quantities or mass production of gears in the above size range. Greatly increased production rates are assured, because of its improved features, including cam-actuated generating motion, and rigid new-type cutter spindle construction. Many gears which previously required separate roughing and finishing cuts can now be completed in one operation, with marked savings in floor-to-floor time and handling time per piece.

Send prints of your bevel gears for an analysis of the cost savings this new generator can offer you.

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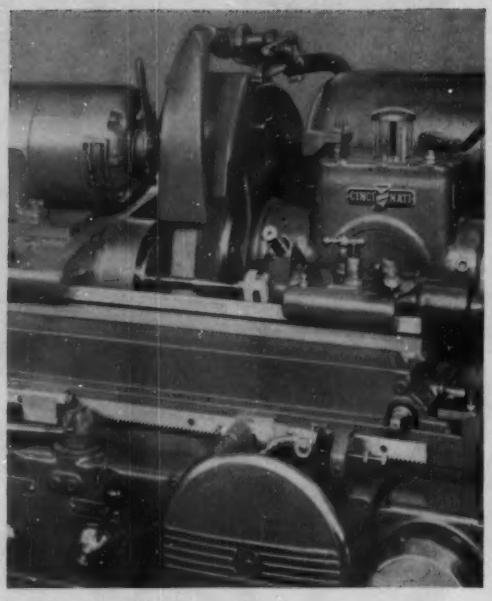
CINCINNATI FILMATIC PLAIN HYDRAULIC GRINDERS

FILMATIC



Infeed grinding the bearing diameter of a cotton picker spindle, CINCINNATI FILMATIC 6" Plain Hydraulic Grinder.

Grinding a gang of collars mounted on an arbor. CINCINNATI FILMATIC 10" Plain Hydraulic Grinder.

CINCINNATI

CINCIN

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES

How much is it costing you to "stand pat" with your old centertype grinders? Chances are you could replace *half of them now with new machines, and immediately gain two big advantages:

1) Higher production at a lower cost

2) Closer accuracy

Here's the way in which CINCINNATI FILMATIC Plain Hydraulics, the 10" size for example, help you attain these desirable results: FILMATIC grinding wheel spindle bearings are an outstanding factor in producing low-cost precision, they never require adjustment or maintenance; two-speed manual table traverse aids the operator in quickly setting up the machine; the table traverse stroke consistently reverses within an accuracy of .004", making it safe to traverse grind close to shoulders. Infeed jobs can be handled with a minimum of operator attention through the Automatic Infeed Equipment. More information about these producers of low-cost precision will be found in Sweet's Machine Tool Catalog, and complete data may be obtained by writing for catalog No. G-603.

CINCINNATI GRINDERS INCORPORATED

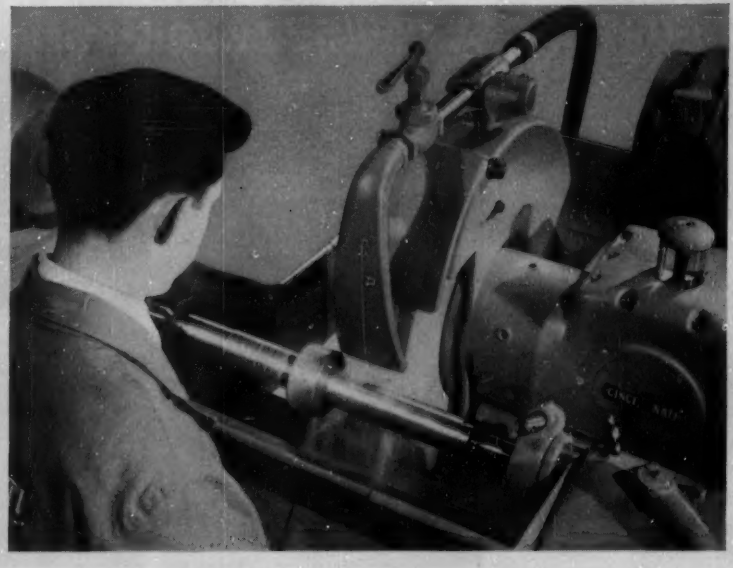
Subsidiary of The Cincinnati Milling Machine Co.

CINCINNATI 9, OHIO

**According to the most recent surveys, 60% of cylindrical grinding machines are over 10 years old. Most of them should be replaced.*

Grinding the sleeve diameter of a gear assembly. CINCINNATI FILMATIC 10" Plain Hydraulic Grinder.

Traverse grinding close to the shoulder of a shaft. CINCINNATI FILMATIC 10" Plain Hydraulic Grinder.



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CINCINNATI FILMATIC Plain Hydraulic Grinders

CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

HIGH-QUALITY GEARS... *and* 93

Fellows

cubic inches of

STOCK REMOVAL

PRODUCTION DATA
Pitch diameter 25.330"
Diametral pitch 3
Width of gear face 4"
Number of teeth 76
Cutter strokes per min. 86
Feed per stroke of cutter .0075"
Depth of roughing cut .640"
Depth of finishing cut .100"
Cutting time (2 cuts) (258 min.)

QUALITY gear jobs of broad variety gravitate to the 36-Type Fellows Gear Shaper — out in the Hoosier State as well as in others east, west, north and south.

It is our good fortune to be able to picture three 36's in the Fairfield Manufacturing Company's line-up of 26 Fellows machines in their plant at Lafayette, Indiana. With them, precision and controlled costs are paramount considerations, a fact well understood and appreciated by Fairfield's wide spread of customers.

As typical of the fine work-planning (and machine performance) we give you the following report-in-detail about the heavy-duty gear being cut on the Gear Shaper nearest the camera. The gear is finished from the solid in two cuts, without a subsequent shaving operation. The blank weighs 156 pounds, and is of 4620 SAE steel. Roughing and finishing is done at the same setup, with the same Fellows cutter. Ninety-three cubic inches or 26 pounds of stock are removed—to produce fine-finish, high-quality gears.

If you aim to put quality into fine or coarse pitch gears, of dimensions best handled on a heavy-duty machine (this includes big coarse-pitch pinions, naturally), the Fellows "36" is something to investigate. » Speeds and feeds quickly adjustable via shift-lever settings. Cutter stroke variable up to 6 inches. Mass rigidity throughout invites fast, heavy cuts. » The nearest Fellows office is your point of contact. Informative literature is available.

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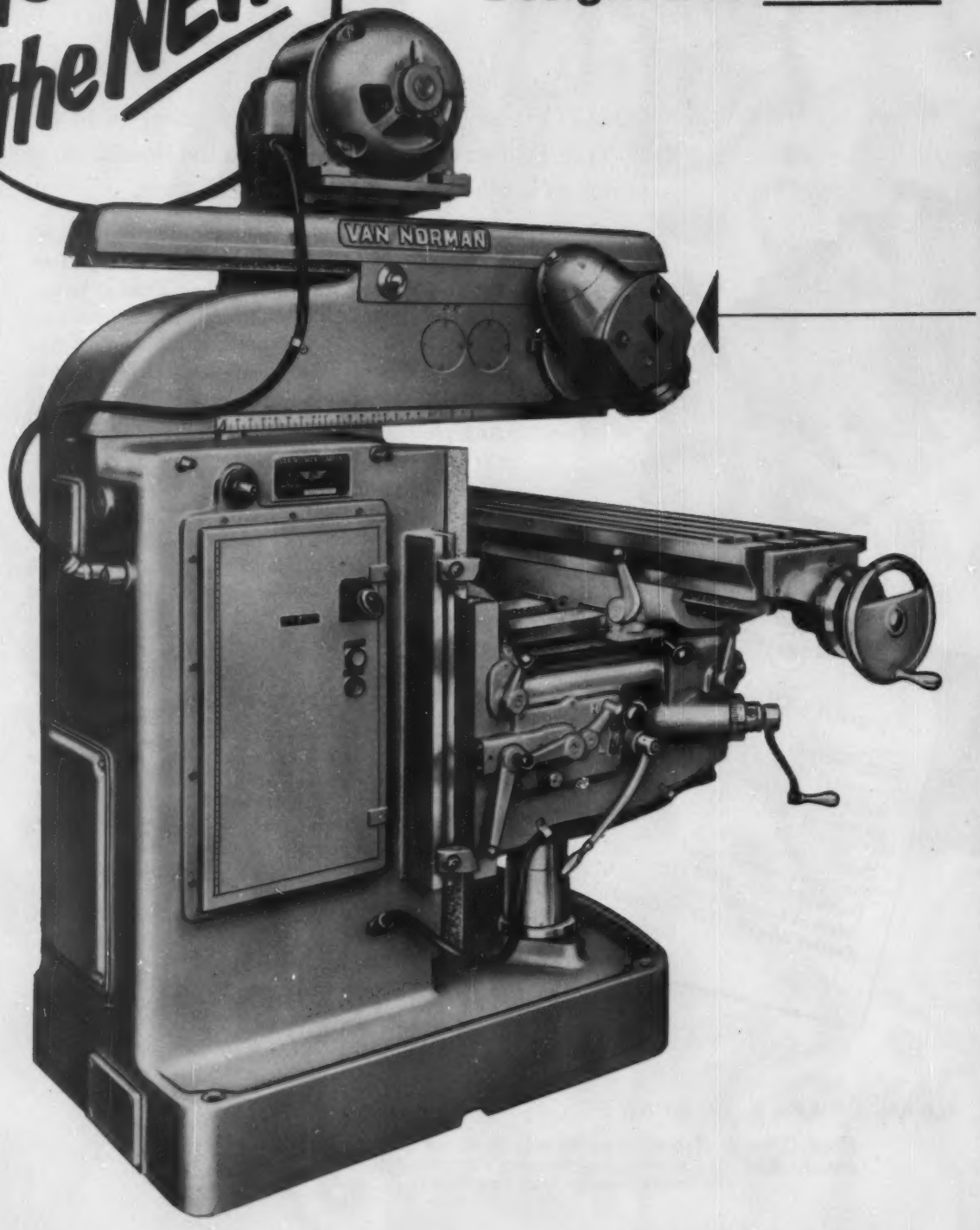
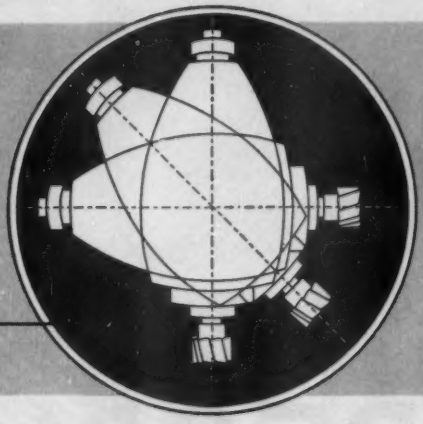
Designed to Increase



No. 24M Ram-Type Miller

Productivity and Lower Milling Costs!



Featuring the Adjustable Cutterhead that permits Horizontal, Angular or Vertical Milling with ONE machine ...reduces work reset-ups, cuts idle machine time... **UP TO 50%**

Plus These Additional Production Increasing Advantages

★ *New Extended, Heavy-Duty Ram* permits maximum cuts over entire ram range . . . increases capacity of the miller. Ram movement, in and out over column, 25".

★ *New Improved Cutterhead* has 90° adjustment. Increases the versatility of the miller.

★ *3HP Spindle Motor* provides ample power for light and heavy cuts.

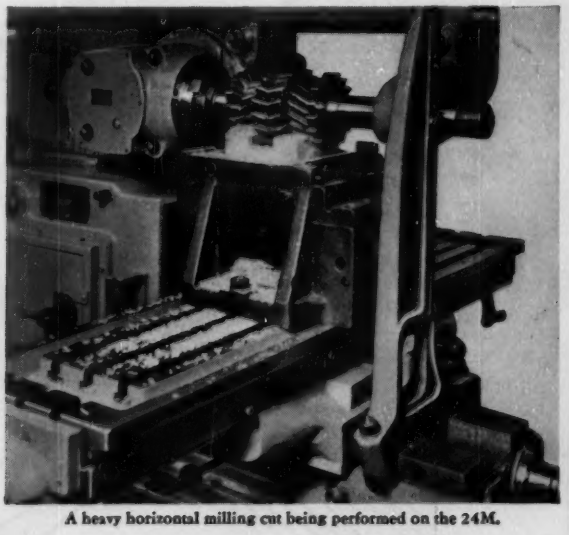
★ *New Direct Drive Feed Motor* mounted on side of knee.

★ *Front and Rear* Controls of power and manual feeds for ease of operation.

★ *New Enclosed Elevating Screw* assures long life.

★ Write for Catalog describing the new Van Norman No. 24M Milling Machine in detail.

No. 24M miller with cutterhead in horizontal position. New direct drive feed motor mounted on knee.



A heavy horizontal milling cut being performed on the 24M.

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Now...
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LANDIS
Machine
COMPANY
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ROLLING MACHINE

. . . the LAN-HY-ROL, generating external threads by the chipless cold-forming process, offers important improvements in production economy and thread finish. This machine is being built under an exclusive license agreement with Pee-Wee Maschinen und Apparatebau of Berlin, Germany, manufacturers of the world-famed Pee-Wee Thread Roller.

The new LAN-HY-ROL offers the same outstanding combination of precision, productivity, and flexibility which has made the German Pee-Wee Thread Roller unequalled in its field. We will share engineering knowledge and experience with Pee-Wee, and jointly conduct an extensive program of research and development. Significant improvements will be incorporated in the LAN-HY-ROL, comparable to those which have made other LANDIS Equipment outstanding in Thread Cutting, Thread Grinding, and Thread Tapping.

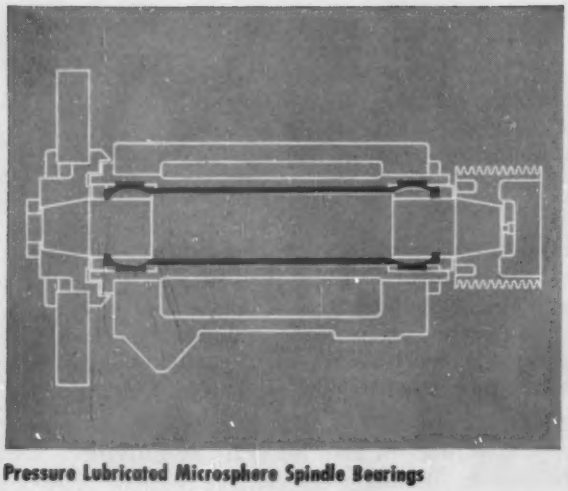
The new LAN-HY-ROL is another forward step in more than 50 years of LANDIS history, during which we have been continuously offering more efficient methods of generating screw threads.

THE WORLD'S LARGEST MANUFACTURERS OF THREADING EQUIPMENT

CUTTING - TAPPING - GRINDING - ROLLING

PERFORMANCE — The Only True Test

14" x 96" Type F
Plain Hydraulic Grinder



Pressure Lubricated Microsphere Spindle Bearings

Vee Belt Headstock Drive

LANDIS

precision grinders

# of a Modern Precision Grinder

Performance is measured this way

- INCREASED PRODUCTION resulting in lower unit costs.
- UNIFORMITY OF WORK PIECES in size and finish.
- MINIMUM DOWNTIME for regular maintenance.

Performance features of Landis Type F plain grinders

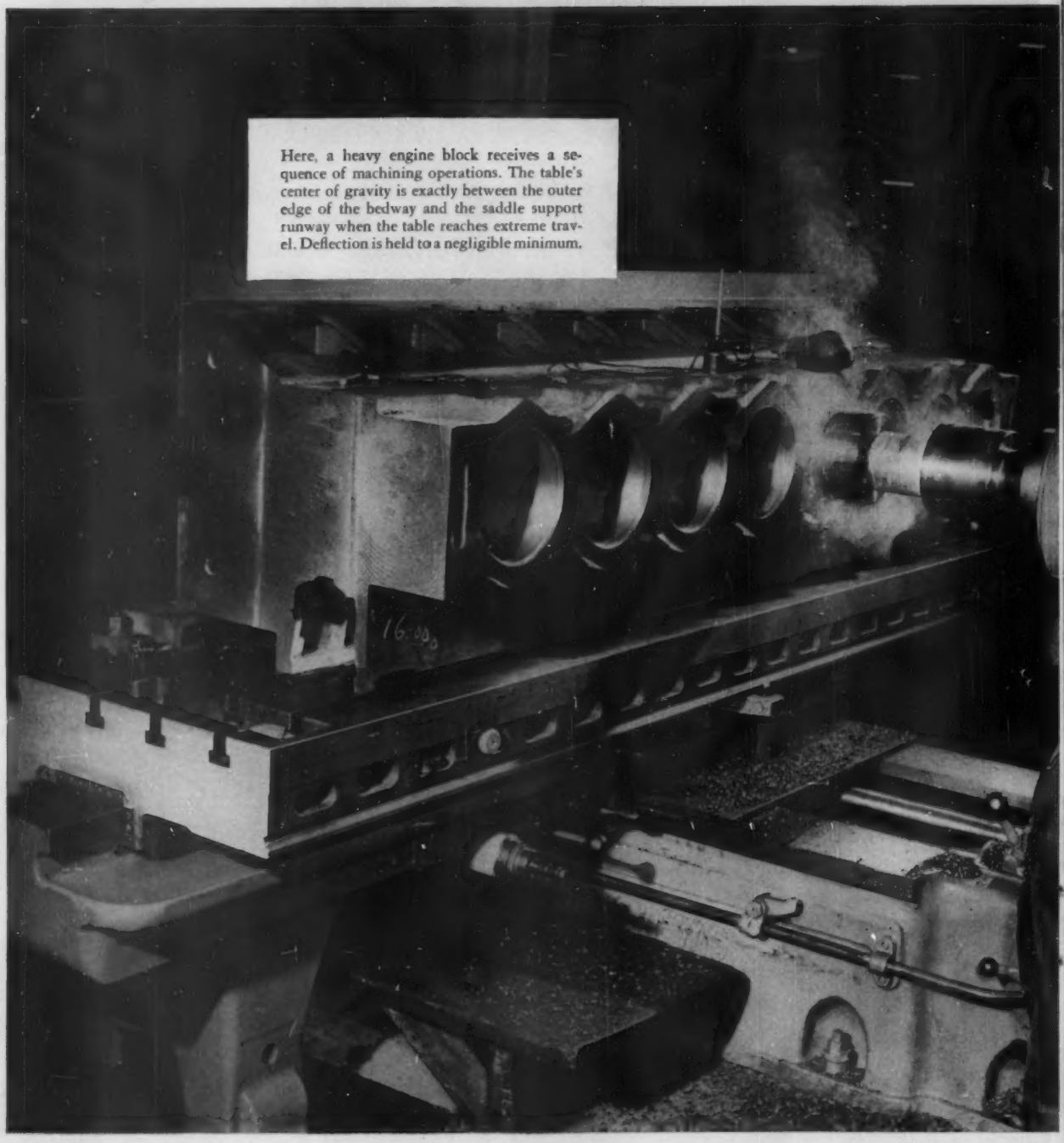
- ADJUSTABLE HYDRAULIC AND ELECTRICAL CONTROLS for selection of correct feeds and speeds.
- CONTROLS EASILY ACCESSIBLE TO OPERATOR reduce operator fatigue.
- MICROSPHERE WHEEL SPINDLE BEARINGS have close clearance for fine finishes and quick sparkout.
- WHEEL SPINDLE has extra large diameter between bearings for maximum rigidity to withstand heavy cuts.
- VEE BELT DRIVES for work and wheel drives give smooth power transmission for fine finishes.
- PRESSURE LUBRICATED WAYS AND SPINDLE BEARINGS insure safe lubrication at all times.

For complete details write for Catalog F-48. Production estimates and tooling suggestions will be made on the basis of your blueprints.

Grouped Operating Controls

Adjustable Hydraulic Controls

G&L 30 Series offers over the widest working



Here, a heavy engine block receives a sequence of machining operations. The table's center of gravity is exactly between the outer edge of the bedway and the saddle support runway when the table reaches extreme travel. Deflection is held to a negligible minimum.

you greatest precision ranges...HERE'S PROOF

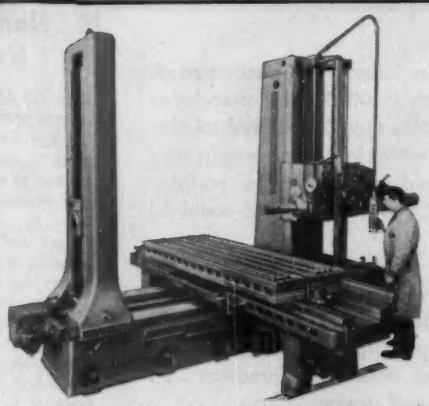
Extended saddle, saddle supports and auxiliary runways are available with G & L 30 Series Table Type Horizontal Boring, Drilling and Milling Machines. This exclusive method of supporting the table takes the risk out of precision-machining large workpieces requiring full range of the machine.

A *fully-supported,* extended saddle is absolutely vital when a long table and high columns are used to precision-machine a sequence of different surfaces on a heavy workpiece. The G&L design incorporates an extended saddle that minimizes deflection and is provided with full support even when the table is at its outermost travel limits.

What's more, G&L has engineered a system of concentric leveling (see lower right) which insures perfect alignment and parallelism between rails, saddle supports, saddle and table.

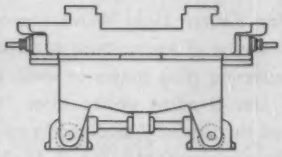
These are only a few of the many advantages you get with a modern G&L Horizontal. A selection of many other standard and optional features gives you the exact machine you need — a machine that's unsurpassed for accuracy, capacity, simplified operation and years of outstanding performance.

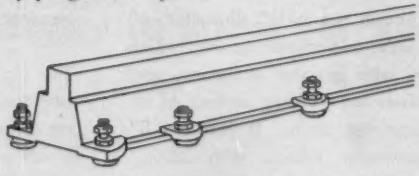
For complete details, see your G&L representative or write for catalog No. 30.



G&L 30 Series machines are available in two basic models — the 350-T (shown) with a 5" spindle and 25 hp, and the 340-T with a 4" spindle and 20 hp. Note how the under-the-floor runways allow the operator to perform his job without having to climb over the machine.

Adjustable brackets with hardened and precision-ground steel rollers. Located one to each support leg, they engage hardened and ground steel rails, are protected by spring-loaded wipers.





On runway, large diameter adjusting screws are threaded through flange and drilled to receive foundation bolts. Rails are sunk into foundation so tops are even with floor level. Rails and machine are separately leveled and saddle support brackets adjust independently.

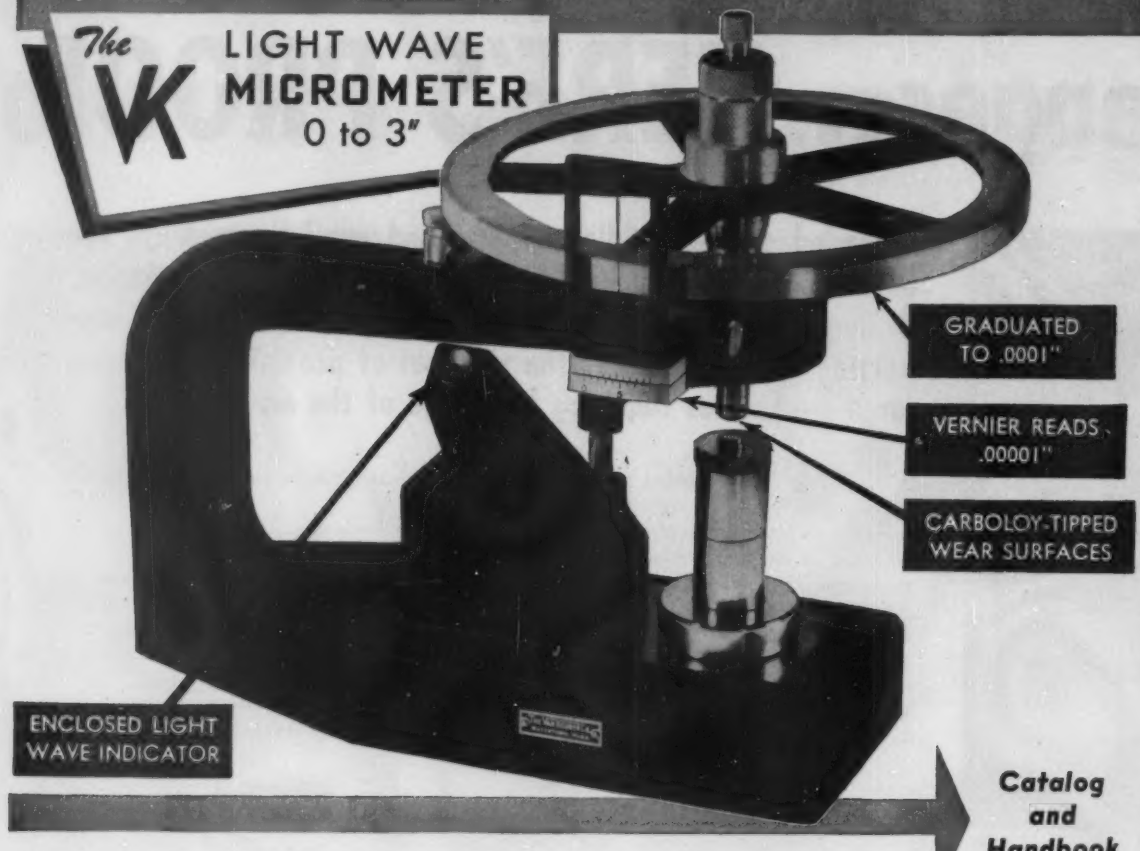
Builders of the world's finest heavy-duty machine tools — Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Openside Planers; Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools.

GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN

for that last hundred-thousandth

The VK LIGHT WAVE MICROMETER 0 to 3"



The Van Keuren Light Wave Micrometer is an instrument of exceptional accuracy, ideal for measuring plug gages or small precision parts. Use it when you're after "that last hundred thousandth" involved in so many of today's measurements. The 0 to 3" instrument shown above has a ½" diameter, 40 threads per inch micrometer screw, which can be made with greater accuracy, and which has 3 times the wearing surface of an ordinary micrometer screw. It has an 8" diameter micrometer wheel, with .0001" graduations 1/10" apart. It has a non-parallax vernier index which enables readings to be made to .00001". It has an index lock and carboloy-tipped anvil and spindle. This sturdy, sensitive instrument weighs only 17 pounds, and is in reality a portable measuring machine of inbuilt and sustained accuracy.

The Light Wave Micrometer is not a comparator. No gage blocks are needed and no errors creep in from worn blocks. It is a direct source of dependable precision . . . fast, accurate and profitable.

Catalog and Handbook No. 35

This 220-page volume represents years of research by the Van Keuren Co. It presents a simple and exact method of measuring screws and worms with wires, tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods. Ask for your copy . . . sent free on request by writing: The Van Keuren Company, 173 Waltham St., Watertown, Mass.

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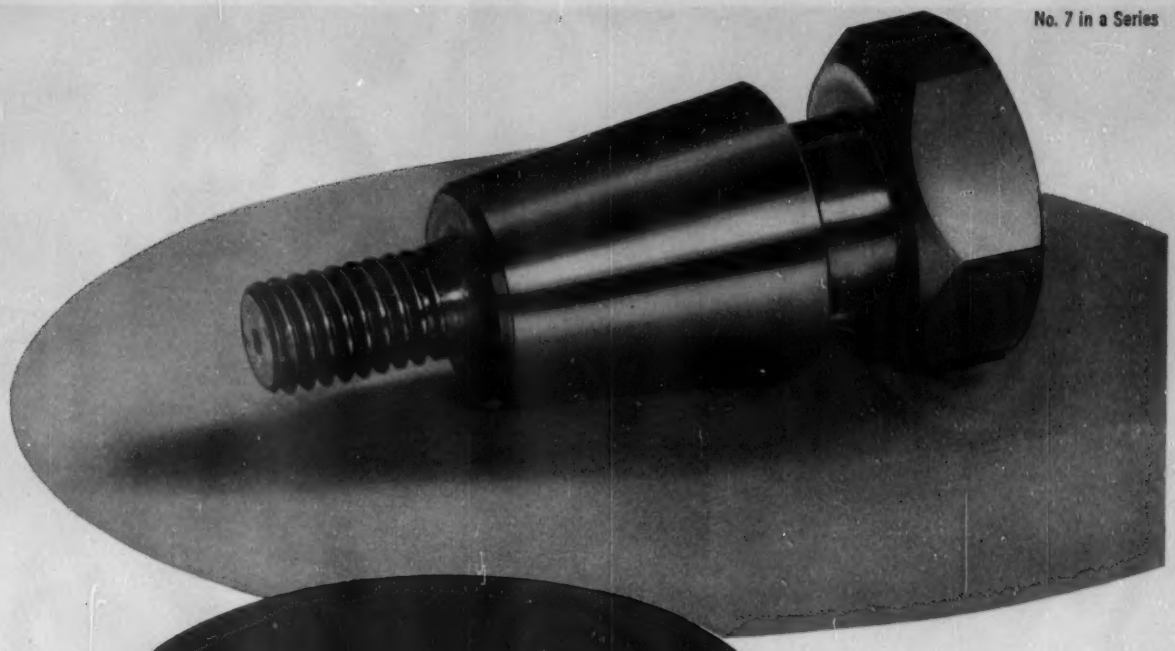
THE Van Keuren CO.,

173 WALTHAM STREET, WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires • Chrome Carbide Taper Insert Plug Gages

No. 7 in a Series



carbide service available

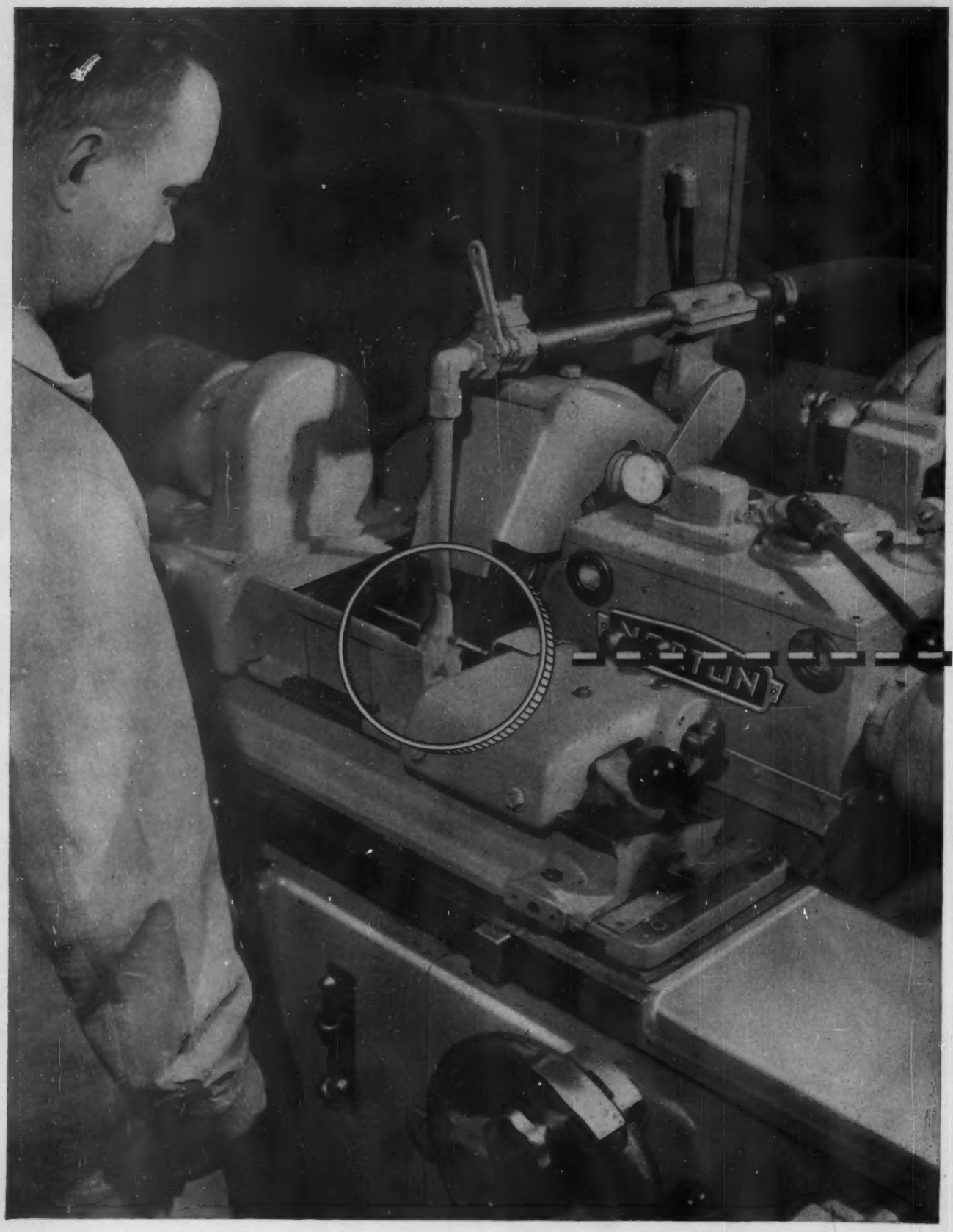
data for comparison

Part	Petcock Center
Machine	1⅛" Six Conomatic
Tools	100% Carbide Tipped
Material	X-1112
Stock Size	1" Hexagon
R.P.M.	1562
Time	8 seconds

Where conditions are favorable, 100% carbide tool-ups on "Automatics" make HSS tools appear as obsolete as ancient tools of carbon steel.

In determining the "favorable" conditions, the Conomatic Carbide Development is of real service to the "Automatic" user. Without risk of production loss or obligation of machine purchase, he gets an eye-witness demonstration of the profit possibilities of 100% carbide tooling to his own work.

Conomatic } CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.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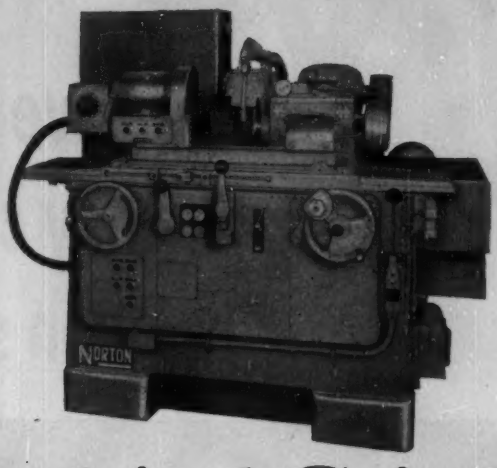


New Norton 4"x18" Type CTU Cylindrical Grinder

gives you high precision plus high production . . .

makes small parts pay off big

Here's a cylindrical grinder you can get as either a Plain Machine for traverse work, or as a Semiautomatic for plunge operations.

Either way you get faster, more accurate, more profitable grinding of a wide variety of small parts. Because either way the 4" Type CTU's Norton-developed features bring a new ease of operation for your men — and a new high in production quality and quantity for *you*.

To name just one of these advanced features, there's the extremely rugged wheel spindle unit that assures enduring precision in jobs ranging from heavy stock removal to fine finishing. But why not get the whole story of this speedy, profit-boosting grinder from your Norton Representative?

Write for Catalog No. 531. And remember: only Norton offers you such long experience in both grinding wheels and machines — to help you produce better products at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass.

***To Economize, Modernize With* NEW**

NORTON

GRINDERS *and* LAPPERS

Making better products . . . to make other products better

District Sales Offices: Hartford • New York • Cleveland • Chicago • Detroit • *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5, Ontario

MX® abrasive products finish as they cut... resist loading even on soft metals, alloys

● Deburring and finishing with MX Mounted Wheel

continually putting **MORE SENSE** in your **ABRAS**

● Smoothing seam of welded aluminum casting with MX Disc

● Portable cutting-off with MX Depressed Center Wheel

Fast, clean-cutting MX abrasive products by CARBORUNDUM *finish* as they cut...whether you are removing stock, surfacing, grinding welds, cutting-off or slotting. The resilient composition of MX products produces a soft, cushion-like cutting action—without chatter—that promotes smooth, uniform finishes. They resist loading... even on the soft metals like copper, magnesium, aluminum, or aluminum alloys.

FOR CUTTING-OFF AND SLOTTING operations, MX Production Cut-off Wheels combine rapid cutting with adequate safety... successfully withstand side pressures and heat shock. MX Depressed Center Wheels are also recommended for light cut-off and slotting with portable equipment—as are MX General Purpose Cut-off Wheels.

FOR ROUGH GRINDING, reducing and blending welds, use MX Discs, Depressed Center Wheels or Straight Wheels—depending on the nature of the job.

FOR FINISHING, polishing, deburring, etc., choose the MX abrasive product that best fits the operation; Straight Wheels, Mounted Wheels, Sticks for hand finishing, Depressed Center Wheels, Discs.

FIND OUT TODAY how these versatile MX abrasive products can help lower your costs, speed your production. Call your CARBORUNDUM Distributor or Salesman, listed in the yellow pages under "Abrasives" or "Grinding Wheels." He offers expert counsel, prompt delivery from complete stocks.

SEND FOR

FREE BOOKLET

ON MX ABRASIVE PRODUCTS

THE CARBORUNDUM COMPANY, Dept. AM 81-44
Niagara Falls, New York.

Rush my copy of Booklet No. 3, "MX Products"

NAME _____

COMPANY _____

STREET AND NUMBER _____

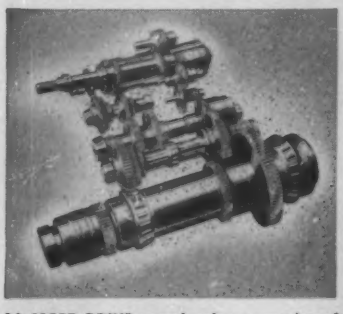
CITY _____ ZONE _____ STATE _____

CARBORUNDUM

REGISTERED TRADE MARK

81-44

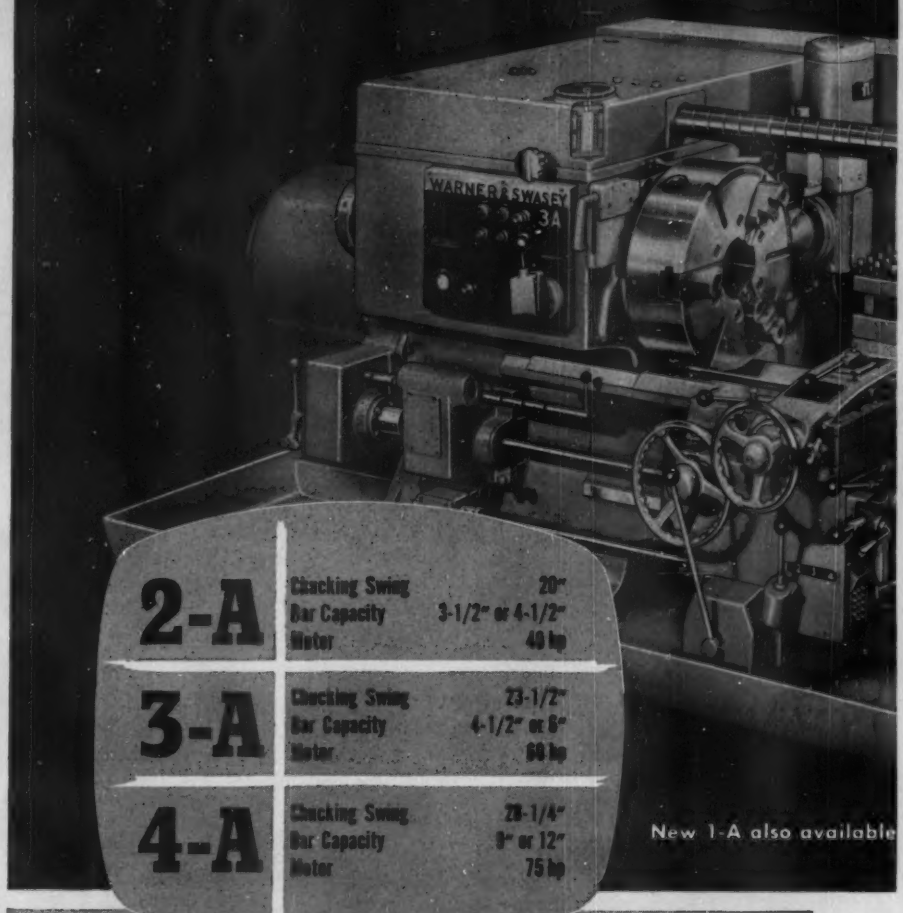
MORE POWER—as much as you'll need for any job! Motor range: 2-A, 15 to 40 hp.; 3-A, 25 to 60 hp.; 4-A, 30 to 75 hp.



16-SPEED DRIVE provides closer grouping of speeds in natural work range to turn more work diameters more effectively—increase production and tool life. 2-speed motor provides 32 *un-duplicated* speeds!

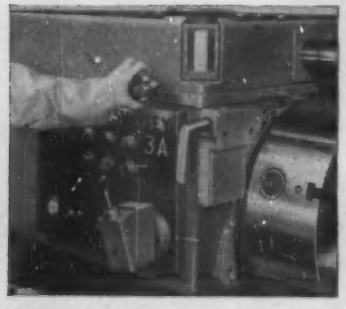
MAINTENANCE-FREE, instant-acting forward and reverse clutch and headbrake unit never needs adjustment—engage smoothly and virtually instantaneously providing fast starts, stops, and reverses.

NEW WARNER & SWASEY INCREASED EFFICIENCY, GREATER

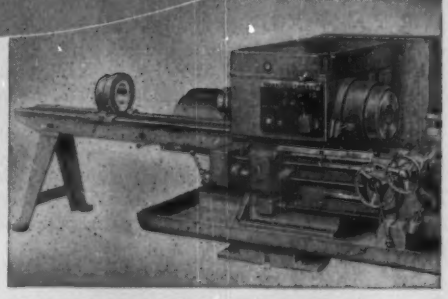


2-A	Chucking Swing	20"
	Bar Capacity	3-1/2" or 4-1/2"
	Motor	40 hp
3-A	Chucking Swing	23-1/2"
	Bar Capacity	4-1/2" or 6"
	Motor	60 hp
4-A	Chucking Swing	28-1/4"
	Bar Capacity	8" or 12"
	Motor	75 hp

New 1-A also available



SPEED PRE-SELECTION made easy by large direct reading indicator dial. AUTOMATIC GEAR SHIFTING boosts production, reduces operator fatigue. A single movement of the control handle without any further attention by the operator slows spindle to crawl speed, then shifts to new speed—all in a matter of seconds.

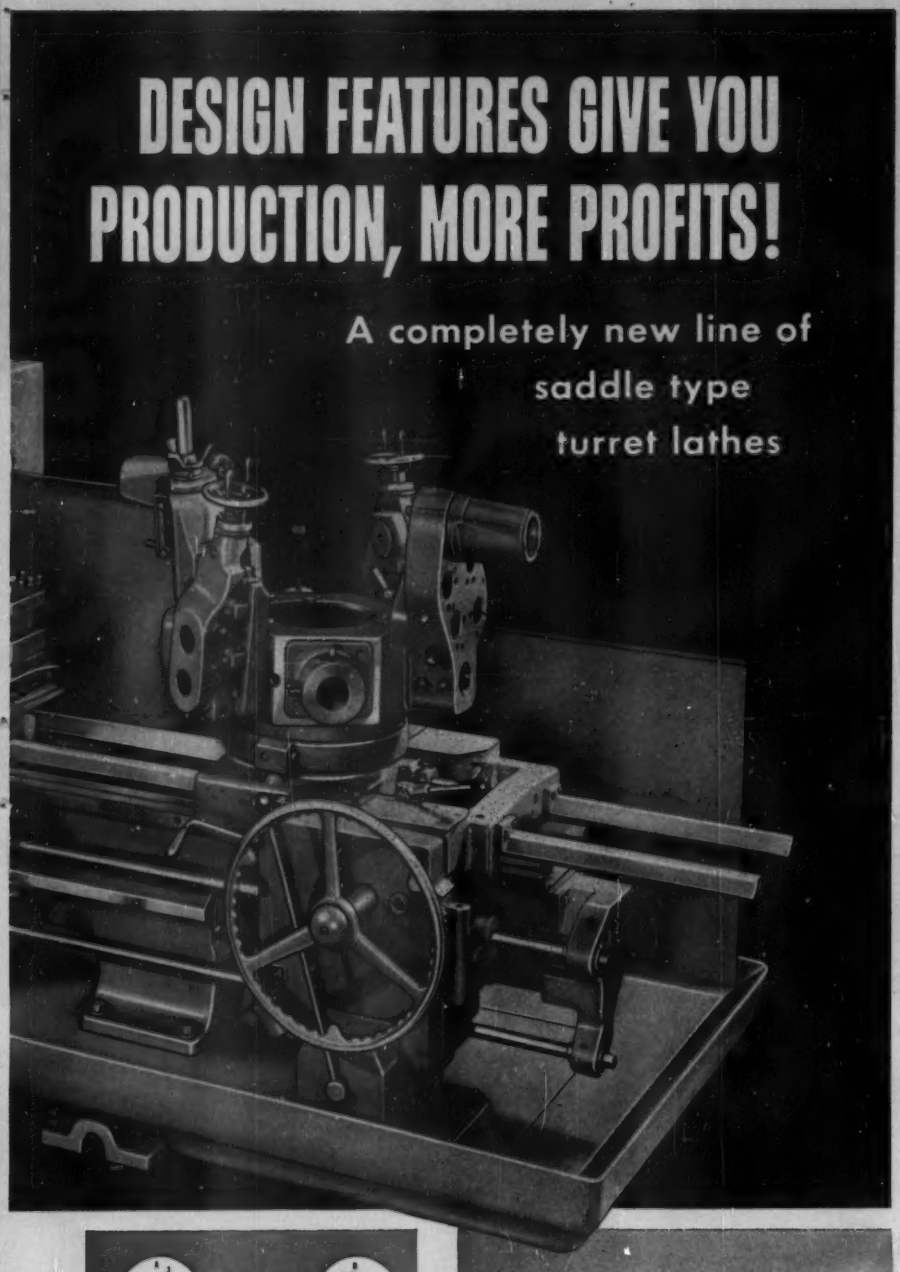


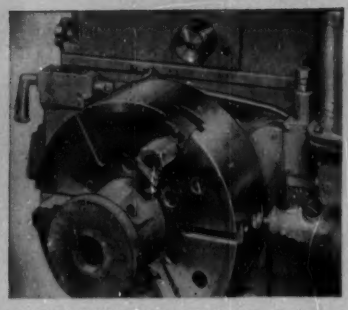
NEW HYDRAULIC CHUCK AND BAR FEED and power return. Provides easier handling, less operator fatigue—increased production.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER &

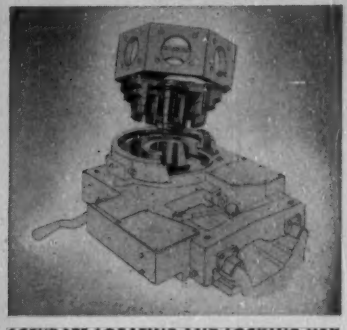
DESIGN FEATURES GIVE YOU PRODUCTION, MORE PROFITS!

A completely new line of saddle type turret lathes

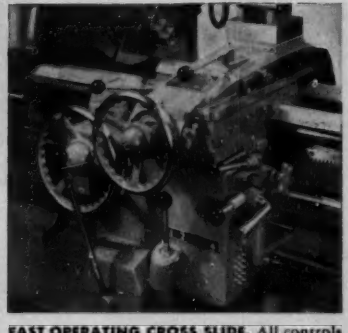




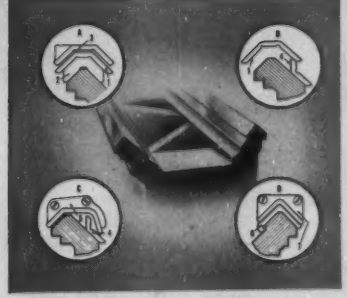
NEW POWER CHUCK WRENCH eliminates back-breaking effort when chucking. Grips and holds delicate work or heavy forgings. Does not obstruct spindle bore.



ACCURATE LOCATING AND LOCKING HEX TURRET assures maintained accuracy. Single lever controls both locating and clamping of turret.



FAST OPERATING CROSS SLIDE. All controls within easy reach. 4-way traversing with rapid traverse lever. Monoshift lever provides fast feed changes. Open type square turret for flexible tooling.



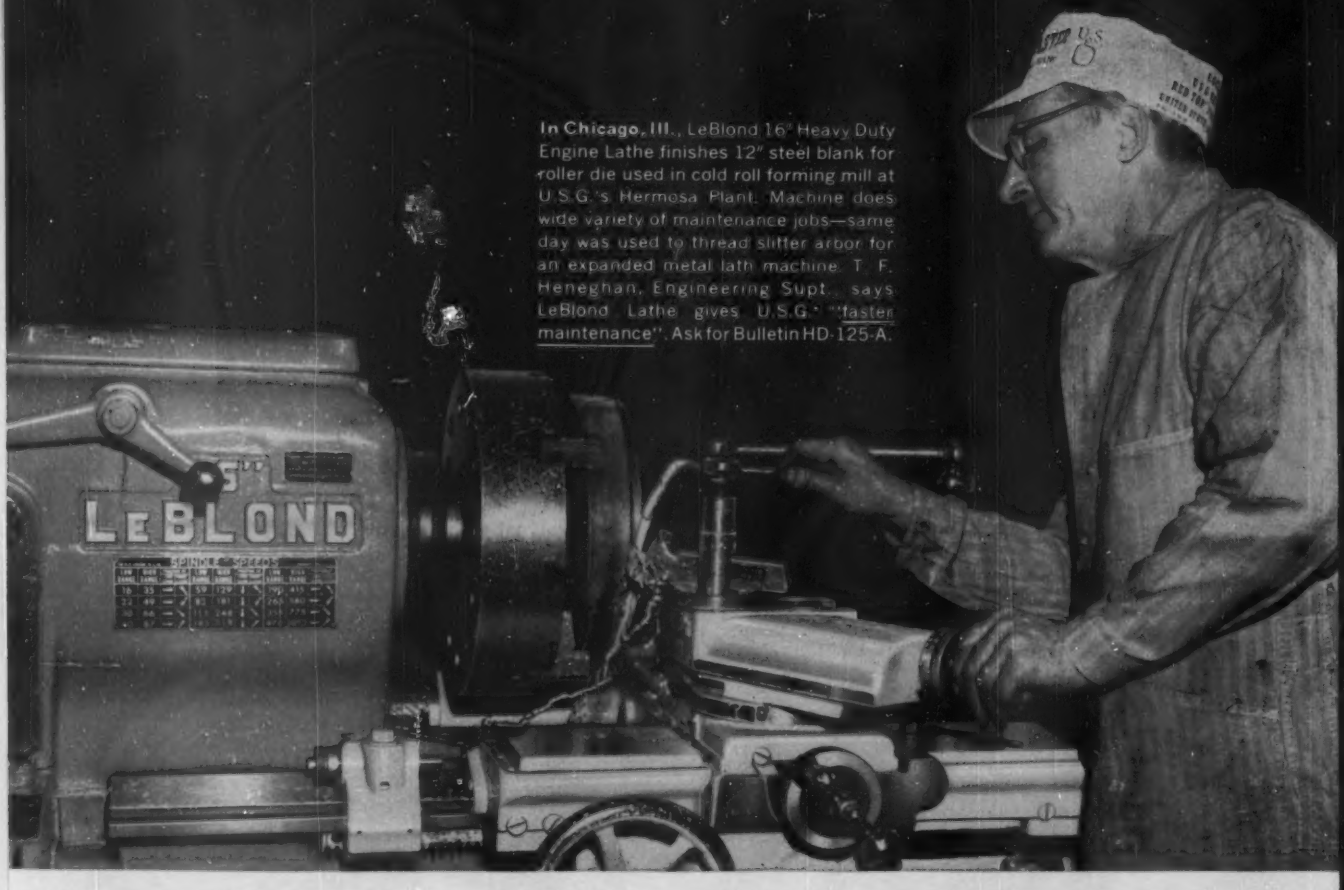
INDUCTION HARDENED VEE-BEDWAYS assure long accurate life. Exclusive way covers protect bearing surfaces from damage by dropped tools, chips, and loss of way lubrication.

INCREASED STRENGTH WITHOUT INCREASED WEIGHT. Scientific diagonal rib design gives over 30% added strength —greater rigidity and long-term accuracy.

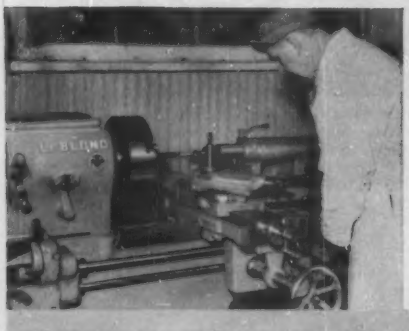
WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

Versatile LeBlond Lathes Knock Down

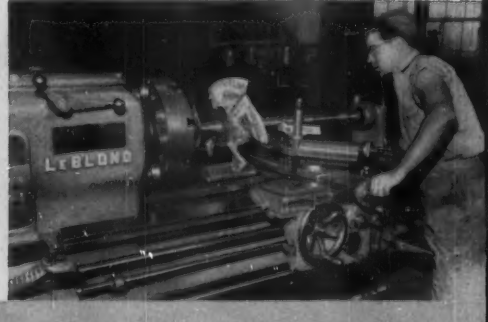


In Chicago, Ill., LeBlond 16" Heavy Duty Engine Lathe finishes 12" steel blank for roller die used in cold roll forming mill at U.S.G.'s Hermosa Plant. Machine does wide variety of maintenance jobs—same day was used to thread slitter arbor for an expanded metal lath machine. T. F. Heneghan, Engineering Supt., says LeBlond Lathe gives U.S.G. "faster maintenance". Ask for Bulletin HD-125-A.



In Norfolk, Va. versatile LeBlond 19" Regal Gap Lathe recuts welded boot scraper shaft. Exacting precision is number one requirement here. Note removable bed section is in place on this job, can be removed to accommodate work up to 27¼" diameter. Ask for Bulletin R-PG-1-A.

In Ft. Dodge, Iowa, LeBlond 17" Regal Lathe bores sprocket to ±.001". Sprocket must fit bearing shaft also turned on the LeBlond. Plant Engineer, John F. Hoertz, says, "This lathe holds tolerances better than previous lathes, saves tool life, speeds up maintenance work . . . ". Ask for Bulletin R-135-A.



In Greenville, Miss., LeBlond 16" Heavy Duty Engine Lathe dresses down shaft for flume return pump, part of the water return system at U.S.G.'s Pressed Board Plant. Other jobs include machining precision bearings for Pelton pump, turning down built-up bushing on universal joint for a steam press—typical of the great variety of turning work now done in U.S.G.'s own shops. Many used to be jobbed out—cost extra time and money. Ask for Bulletin HD-125-A.

"Upkeep" Costs for U.S. Gypsum

16 U.S.G. Plants from Maine to California

depend on LeBlonds for speedy, economical maintenance.

Dozens of turning jobs that used to be "farmed out" by U.S. Gypsum Plants now get done at less cost and *days sooner*, right in U.S.G.'s own maintenance shops—thanks to versatile LeBlond Lathes.

With U.S.G.'s quarry-to-finished-product operation, plant machinery ranges from huge mining equipment—to processing machinery—to speedy conveyors—to intricate packaging machines that bundle up finished products. Who knows what the LeBlond's next "fix-it" turning job will be? Today it's dressing down the shaft of a flume return pump. Tomorrow it's finishing a precision bearing where the critical tolerance goes down to tenths!

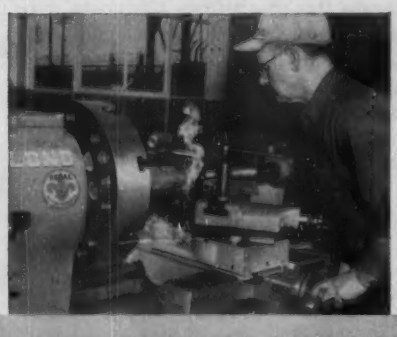
Convenience, low cost, dependability, wide variety of work—that's what LeBlond Lathes mean to maintenance men at U.S. Gypsum. And that's why there's at least one LeBlond Lathe on maintenance work in each of 16 U.S.G. Plants—from Maine to California.

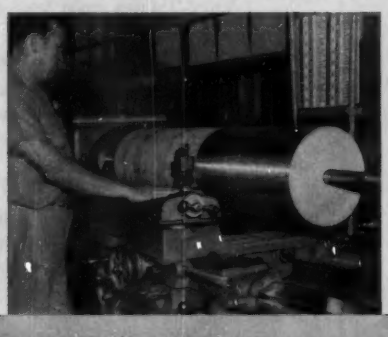
How many of *your* turning jobs did you send out of your plant this month? Is the "other fellow's" profit a large chunk of your maintenance cost?

Call your nearby LeBlond Distributor. Show him the variety of turning work that your maintenance requires. Tell him how long it takes to get it done elsewhere, what it costs. From LeBlond's complete line of 76 different lathe models, he can recommend lathes that will handle all of it—or at least a major portion. You'll get the work done sooner, dependably, and without an outsider's profit to pay for.

For complete information contact your LeBlond distributor or write—

THE R. K. LEBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO





LeBLOND of Cincinnati

In Alabaster, Mich., LeBlond 24" Regal Lathe threads take-up bolt for 4½ yard Bucyrus-Erie Rock Shovel. Four threads per inch, speed 95 rpm. Plant Engineer, E. John Minderman, says this LeBlond Lathe handles work ranging "from very small parts found in electrical and hydraulic equipment to large gears, shafts and armatures that require the full capacity of the machine". Reports "very dependable service". Ask for Bulletin R-163-A.

In Plaster City, Calif., U.S.G. saves at least seven days by machining this roller on the LeBlond 20" Standard Duty Engine Lathe—right in their own shop. Job used to be sent out, took up to ten days to complete. Another LeBlond Lathe is still in regular use at the Plaster City Plant, after over 25 years of maintenance work. Plant Engineer, R. W. Langewisch, says LeBlond Lathes "save time, expense, increase shop capacity". Ask for Bulletin SD-250-A.

World's largest builder of a Complete Line of Lathes—for More than 66 Years.

Fast Movers or Shelf Warmers?

Count BOTH

(and 1,001 Other Items)

WITH

VARY-TALLY

Multiple-Unit Reset Counter

How Can the Vary-Tally count for you? Write for news sheet and prices.

Vary-Tallies help you separate the sheep from the goats, the big ones from the little ones, the red ones from the green ones — in manufacturing, sales, accounting, researching and what not!

Vary-Tallies will do *any* counting job you want in any combination up to 6 banks high, 12 units wide (with a minimum of 2 units wide). Yes, you can count on 'em or with 'em *to your profit* — note these features of construction:

- **Easily Readable from Any Angle . . . Bold figures Always Centered in Window . . . No Glare . . . Figures not Covered by Fingers in Operation**
- **Easily Portable, yet Ruggedly Built for Long Wear**
- **All Parts Corrosion-Resistant; Working parts of Hardened Steel**
- **Separate Counting Units Can be Rotated like Tires on a Car, to Distribute Wear Evenly**
- **Not Affected by Extreme Heat or Cold**
- **Individual Tag Above Each Counter-Window — Not Strip Tabs**
- **Veeder-Root Quality in Every Part**

"The Name that Counts"

VEEDER-ROOT INC.

HARTFORD 2, CONNECTICUT

Chicago 6, Ill. • New York 19, N. Y. • Greenville, S. C. • Montreal 2, Canada • Dundee, Scotland • Offices and Agents in Principal Cities

"Now with a G Bond wheel we can go completely around a 16-inch face mill," writes the tool supervisor of a New Jersey plant. "Previously, due to wheel wear we had to index this type of cutter at four different positions. Now, on a finish cut, we can go completely around, and the cutter runs absolutely true within .0005 inches. These new G Bond wheels have very good, cool cutting action, don't break down or leave jagged edges . . . We'll be using plenty of them on our tool room jobs."

New G BOND sets new records in tool room grinding

Here's Proof... Users praise the many "TOUCH of GOLD" *advantages in Norton pace-setting wheels*

Norton G Bond wheels have sure started something! In tool and cutter grinding, as in many other forms of precision and semi-precision grinding, they're giving users an entirely new slant on how efficient, long-lasting and profitable wheels can be.

What Users Say About New G Bond Wheels

"Good finish, longer wheel life."

"Heavier feeds without burn."

"Run absolutely true."

"No breakdown—no jagged edges."

"Cut freely, hold shape with no burning."

"They show how a real wheel will cut."

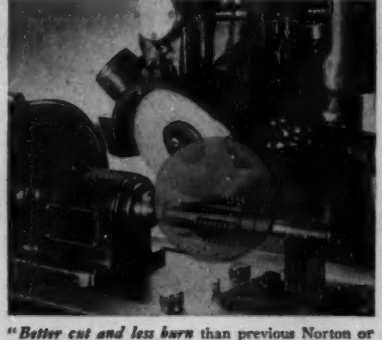
G Bond Alundum Wheels In Your Own Tool Room* will take heavier cuts in expensive, heat-sensitive steels without drawing temper. They'll reduce tool spoilage, give you closer tolerances and smoother finishes than you ever got before — with fewer wheel changes and machine adjustments . . . Those are the value-adding, money-saving "Touch of Gold" advantages that make G Bond wheels outperform any others you ever used.

Your Norton Distributor can recommend the right G Bond wheels for your jobs. Contact him or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your classified phone directory. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass. W-1532

NORTON ABRASIVES

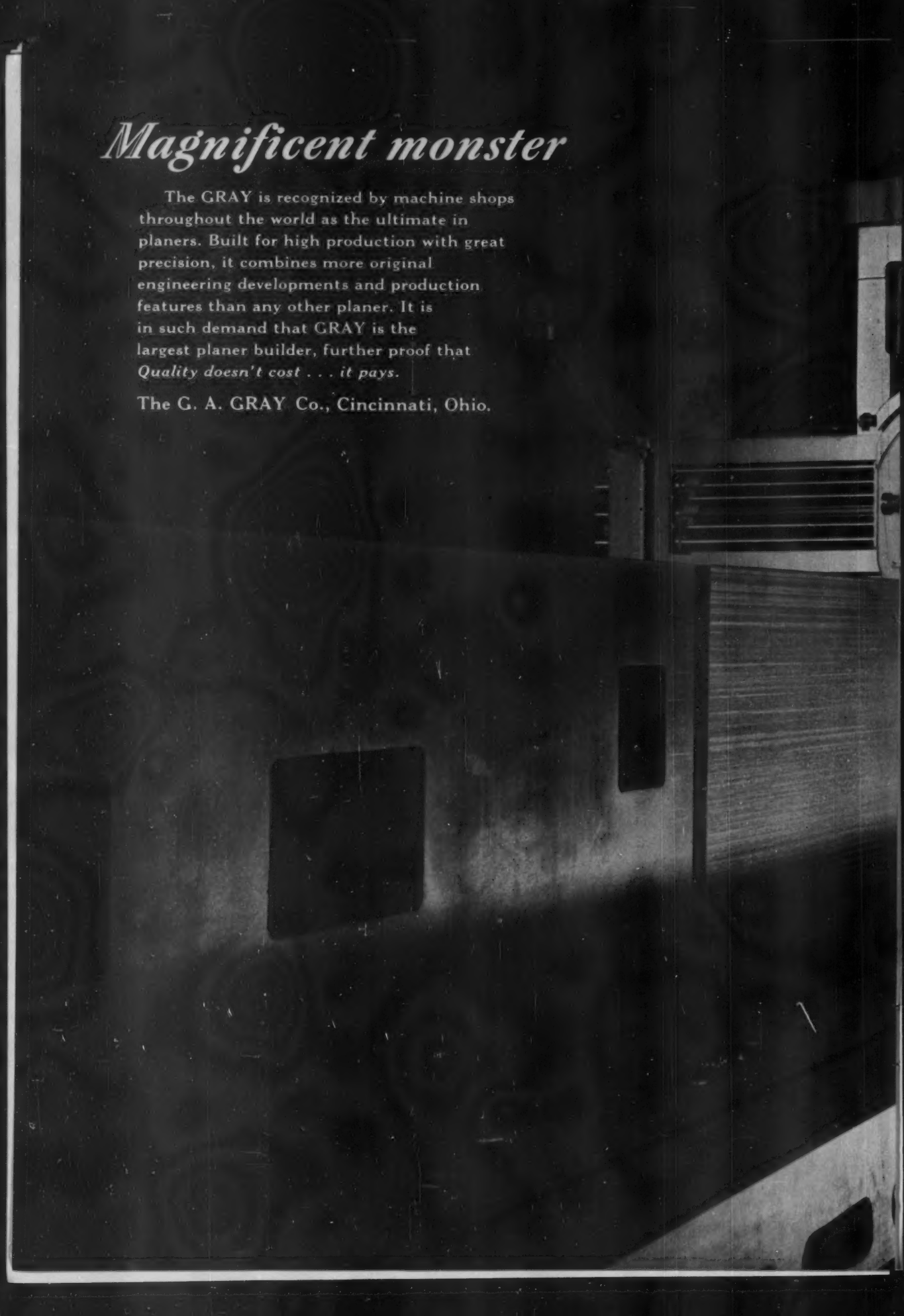
Making better products... to make other products better

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries



"Better cut and less burn than previous Norton or other make wheels. We're re-ordering 250 G Bond wheels," was the comment from this Ohio tool company.

"We're using heavier feeds with G Bond wheels — and getting faster sharpening."



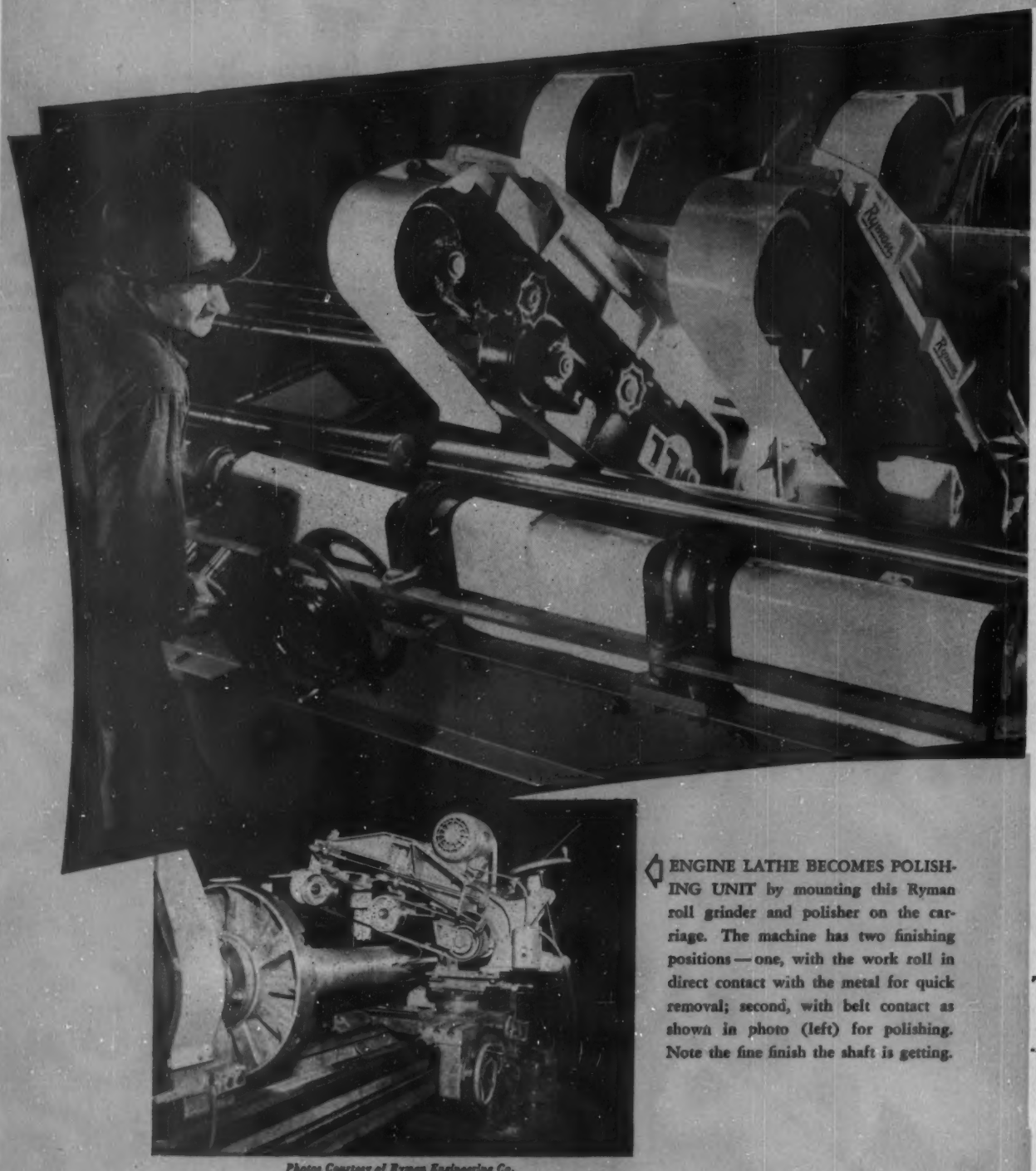
Magnificent monster

The GRAY is recognized by machine shops throughout the world as the ultimate in planers. Built for high production with great precision, it combines more original engineering developments and production features than any other planer. It is in such demand that GRAY is the largest planer builder, further proof that *Quality doesn't cost . . . it pays.*

The G. A. GRAY Co., Cincinnati, Ohio.

GRAY

Roll finishing



ENGINE LATHE BECOMES POLISHING UNIT by mounting this Ryman roll grinder and polisher on the carriage. The machine has two finishing positions — one, with the work roll in direct contact with the metal for quick removal; second, with belt contact as shown in photo (left) for polishing. Note the fine finish the shaft is getting.

Photos Courtesy of Ryman Engineering Co.

production Soars

with these machines and

BEHR-MANNING Abrasive Belts

There's a new approach to roll grinding and polishing these days. True creative engineering as shown in these Ryman machines, and the use of BEHR-MANNING Belts, are solving tough production problems.

Descriptions of the many profit-saving applications of abrasive belt grinding involving BEHR-MANNING® Belts, would fill a book. The material is on file at your nearest BEHR-MANNING Application Clinic, with machines on hand to test time-saving methods on samples of your own work. Make a date through your local BEHR-MANNING Representative, or write direct to Behr-Manning, Troy, N. Y., Dept. AM-4.

In Canada: Behr-Manning (Canada) Ltd., Brantford.
For Export: Norton Behr-Manning Overseas Inc., New Rochelle, N. Y., U.S.A.

HERE IS A SET-UP FOR REAL PRODUCTION in an important steel Plant (upper left). The two Ryman machines do a rough and finish polishing job as the bars are fed past them, while rotated on rubber covered rollers. The machine is equipped with mechanical means of raising the finished bars to the table shown at right of the picture.

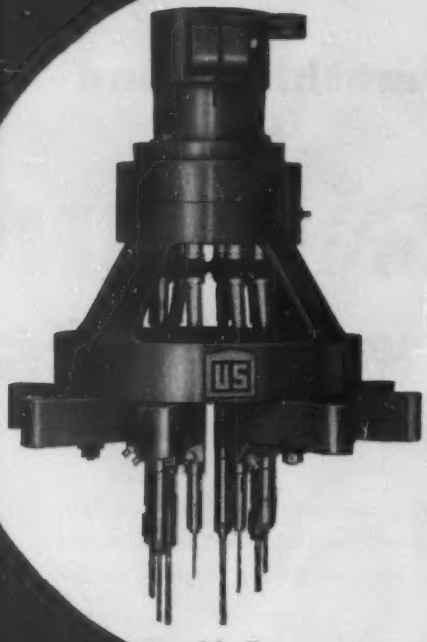
BEHR-MANNING® CORPORATION
division of NORTON Company

▲ COATED ABRASIVES
▲ SHARPENING STONES
▲ PRESSURE-SENSITIVE TAPES

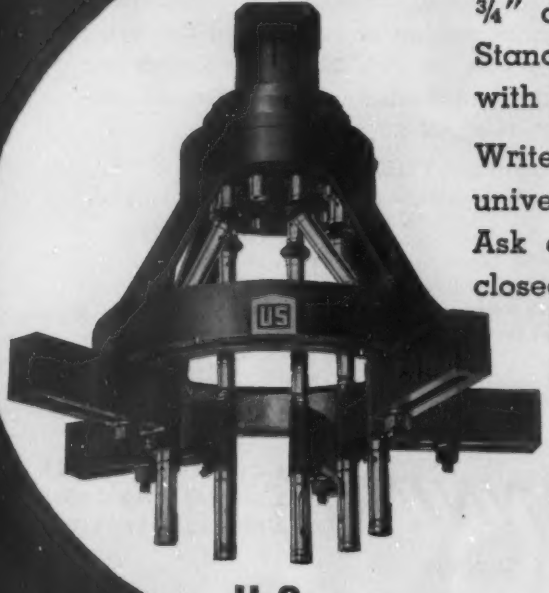
C-4

For the newest in coated abrasives... watch BEHR-MANNING!

KEEPING UP WITH THE JONESES



U-1



U-2

The "Joneses" and the companies they own save money, time and effort by relying on "US" Adjustable Multiple Spindle Drill Heads with *QUICK-CHANGE* universal joint assemblies.

We give the "Joneses" and you —immediate delivery.

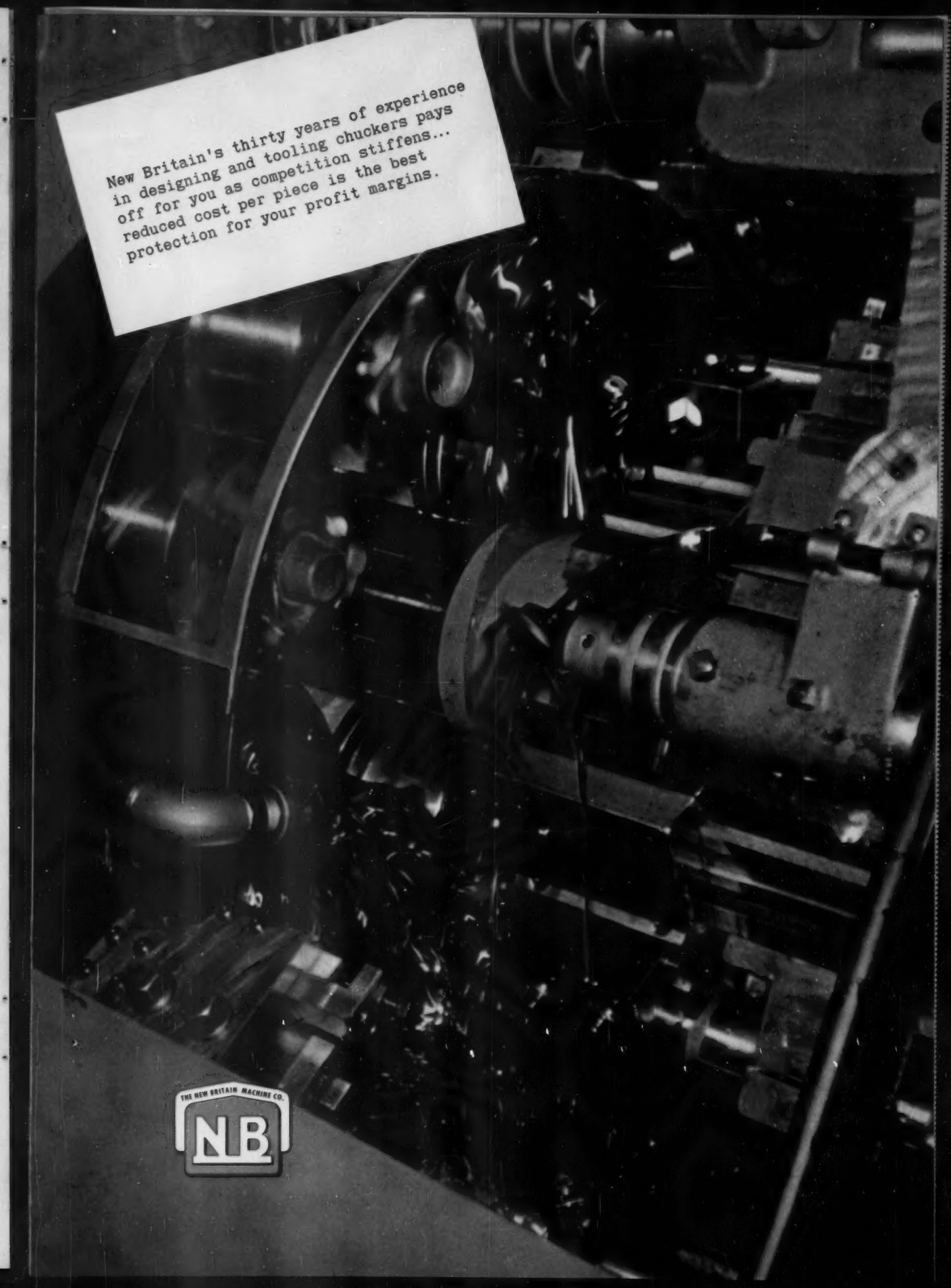
The U-1 Head—two to eight spindles—can be adjusted to a minimum distance between spindles of 11/16" anywhere in an area of a 6" diameter circle.

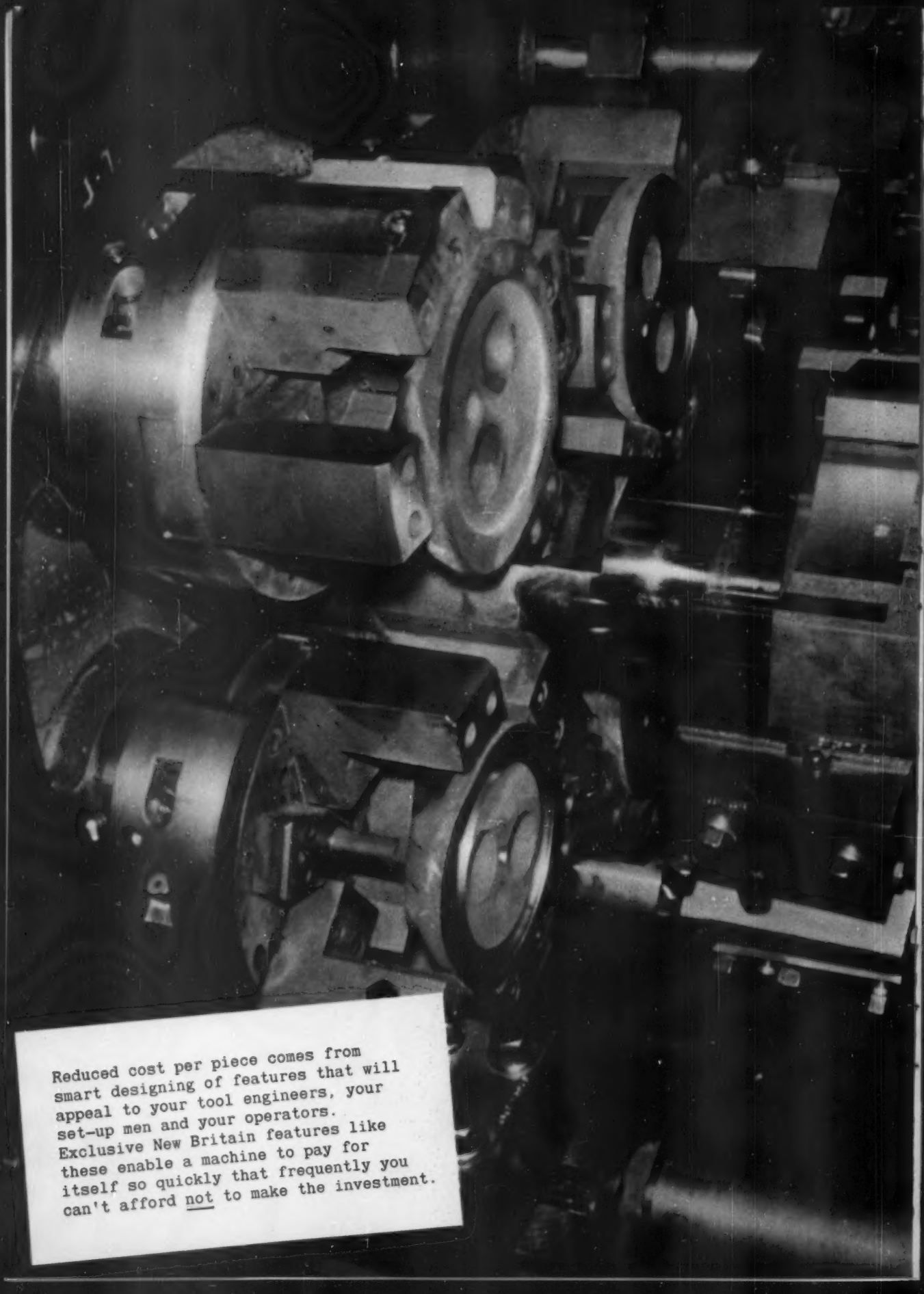
The U-2 Head has two to twelve spindles, each built to drill up to ¾" diameter hole in cast iron. Standard spindles are furnished with No. 1 or 2 Morse Taper.

Write for details on any type of universal joint adjustable head. Ask also about our totally enclosed gear driven adjustable, fixed center, or individual lead screw tapping heads.

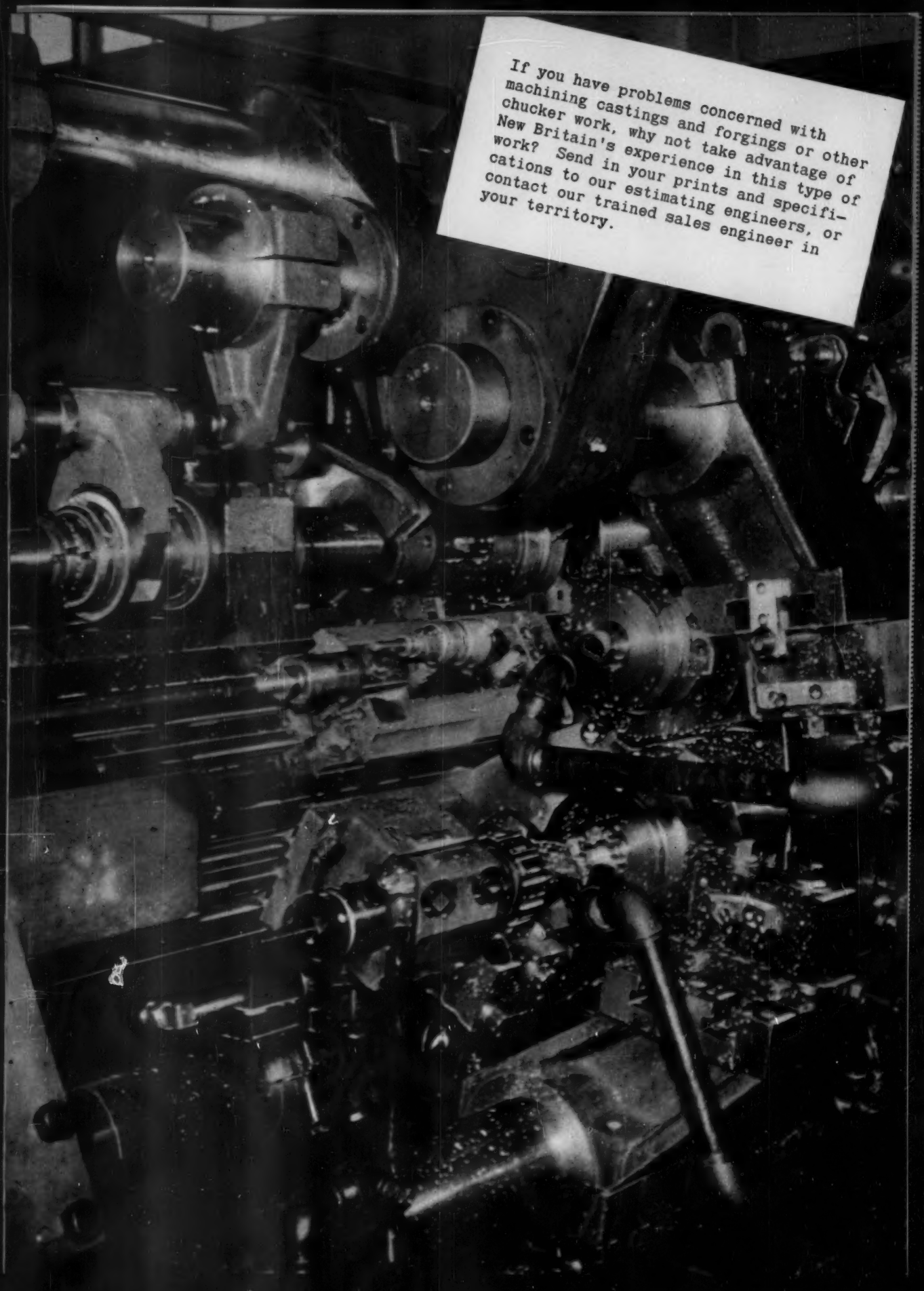
US HEADS SINCE 1915

UNITED STATES DRILL HEAD CO.
616-618 Burns St., Cincinnati 4, Ohio


New Britain's thirty years of experience
in designing and tooling chuckers pays
off for you as competition stiffens...
reduced cost per piece is the best
protection for your profit margins.
THE NEW BRITAIN MACHINE CO.
NB



Reduced cost per piece comes from smart designing of features that will appeal to your tool engineers, your set-up men and your operators. Exclusive New Britain features like these enable a machine to pay for itself so quickly that frequently you can't afford not to make the investment.

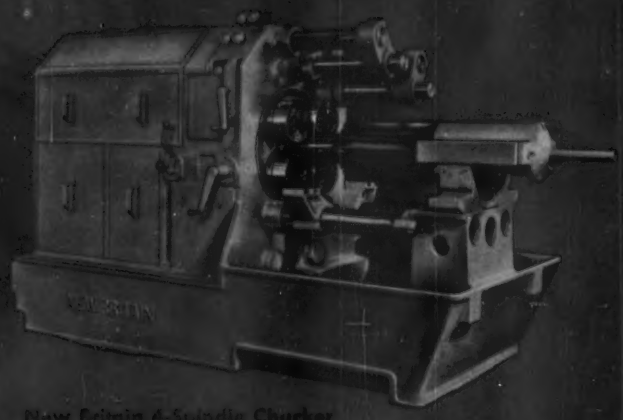


If you have problems concerned with machining castings and forgings or other chucker work, why not take advantage of New Britain's experience in this type of work? Send in your prints and specifications to our estimating engineers, or contact our trained sales engineer in your territory.

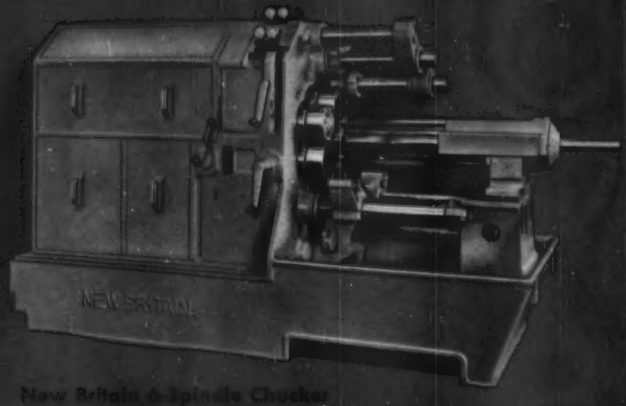
SUSTAINED ACCURACY and PRODUCTIVITY

New Britain open end chuckers feature wide-open accessibility to all tools, and convenient chip removal, with power and rigidity to handle the heaviest cuts. Their high initial accuracy is preserved by such exclusive features as automatic spindle carrier lifting and clamping which prevent wear and weave. Swinging-type forming arms are positionable horizontally and radially without overhang and without exposed surfaces to be affected by grit or chips. They have both radial and longitudinal motion and will handle any length or diameter job within the machine's capacity.

For full information, write us, or consult the New Britain Sales Engineer in your area.



New Britain 4-Spindle Chucker



New Britain 6-Spindle Chucker

New Britain 8-Spindle Chucker

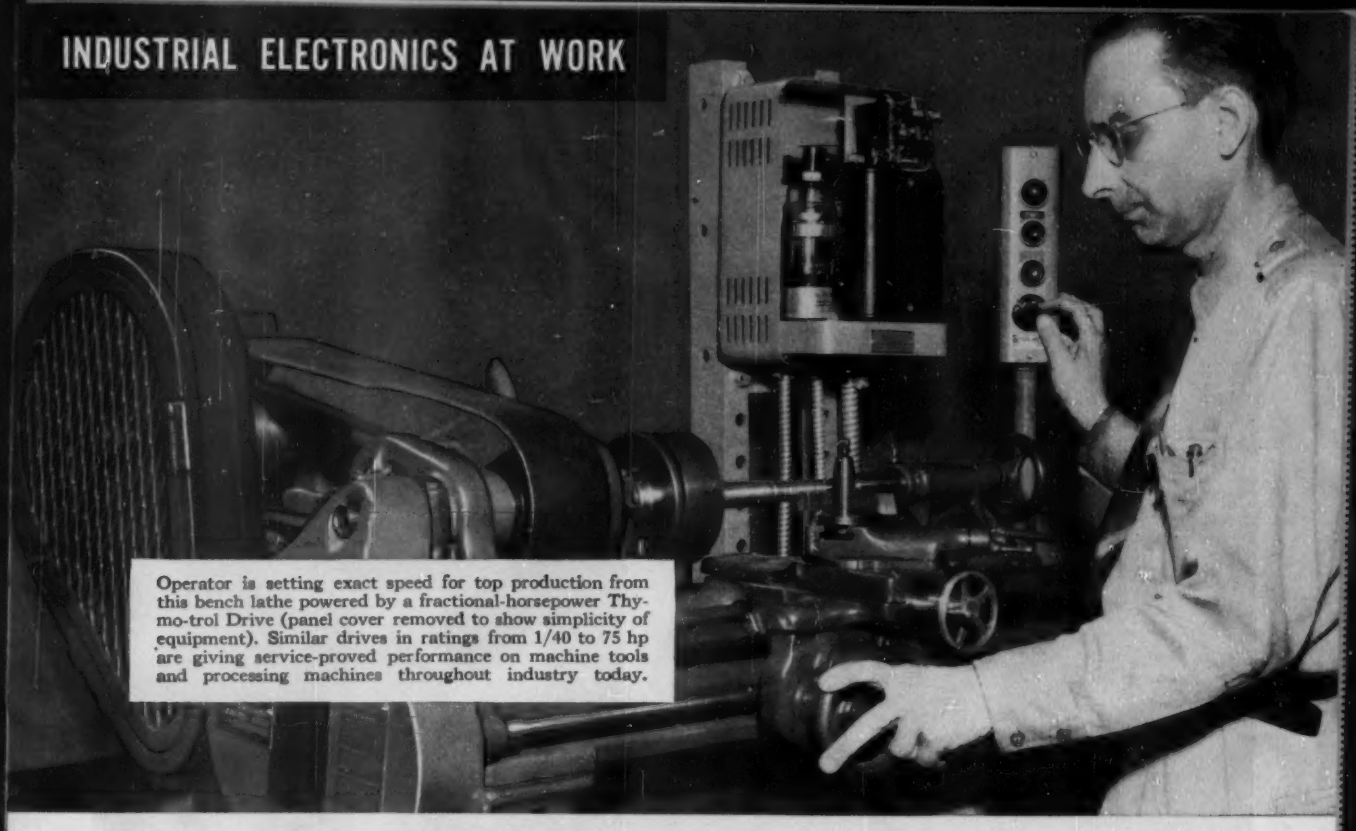
Our general catalog is filed in the Sweet's Machine Tool Catalog File.

AUTOMATIC BAR and CHUCKING MACHINES • PRECISION BORING MACHINES
LUCAS HORIZONTAL BORING, DRILLING and MILLING MACHINES
NEW BRITAIN "GP" COPYING LATHES

The NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division, New Britain, Connecticut
Lucas Machine Division, Cleveland 5, Ohio

INDUSTRIAL ELECTRONICS AT WORK



Operator is setting exact speed for top production from this bench lathe powered by a fractional-horsepower Thy-mo-trol Drive (panel cover removed to show simplicity of equipment). Similar drives in ratings from 1/40 to 75 hp are giving service-proved performance on machine tools and processing machines throughout industry today.

When close speed regulation is required . . .

General Electric THY-MO-TROL* Drives Can Help You Cut Production Costs

EXACTLY THE RIGHT SPEED FOR TOP PRODUCTION is assured by the *wider speed ranges* offered by G-E Thy-mo-trol Drives . . . your machines are more versatile and more productive for a greater variety of jobs. Typical Thy-mo-trol Drive speed ranges are 5:1, 20:1, 50:1 and 100:1; and, if required, much higher speed ranges are possible under certain conditions.

IMPROVED PRODUCT QUALITY AND LESS SPOILAGE are made possible by the *infinite number of speed steps* and *closer speed regulation* provided by G-E Thy-mo-trol Drives. You get and hold the exact speed required for every job and maintain proper speed throughout your entire operating cycle.

GREATER PROTECTION FOR DRIVE AND MACHINE is yours with all full-wave G-E Thy-mo-trol Drives because current limiting features eliminate the danger of overloading machine or drive. If the driven machine should jam, the motor will automatically stall before torque becomes excessive.

*Reg. Trademark of the General Electric Co.

FOR COMPLETE INFORMATION on these and the many other features of G-E Thy-mo-trol Drives contact your nearest G-E Apparatus Sales Office or send in the coupon shown below.

General Electric Company, Section B790-1
Schenectady 5, New York

- ☐ GEA5337, Thy-mo-trol Adjustable-speed Drives. Up to 30 hp.
- ☐ GEA5827, Precision Controlled Thy-mo-trol Drive. ¾ to 10 hp.
- ☐ GEA5829, Simplified Thy-mo-trol Drive. ¾ to 3 hp.
- ☐ GEA5179, Half-wave Thy-mo-trol Drive. Up to ½ hp.
- ☐ GEC-703, Full-wave Thy-mo-trol Drive. ¼ to ½ hp.

Please send me the bulletins checked

- ☐ for reference only
- ☐ for planning an immediate project

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

GENERAL ELECTRIC

Arthur R. Wiley, National Warehouse Manager of A. G. Spalding & Bros., Inc., tells why:

He's famous for his fast delivery!

"Imagine the stands filled," says Spalding's Arthur Wiley, "the major league teams in their dug-outs, the mounting expectation — and no baseballs!

"It sounded like an 'emergency.' The balls used in all major league games are specially tested for perfection. The club was half-way across the country from our Chicopee, Mass. plant and a double-header scheduled.

"But we're used to delivering fast. We solve situations like this week-in and week-out by relying on Air Express.

"So, we just called Air Express on this job. The balls were flown west, were delivered and actually in play on the field a few hours later.

"We use Air Express throughout the year to ship all kinds of sports equipment throughout the country.

"Practically all these shipments cost less with Air Express than with any other air service."

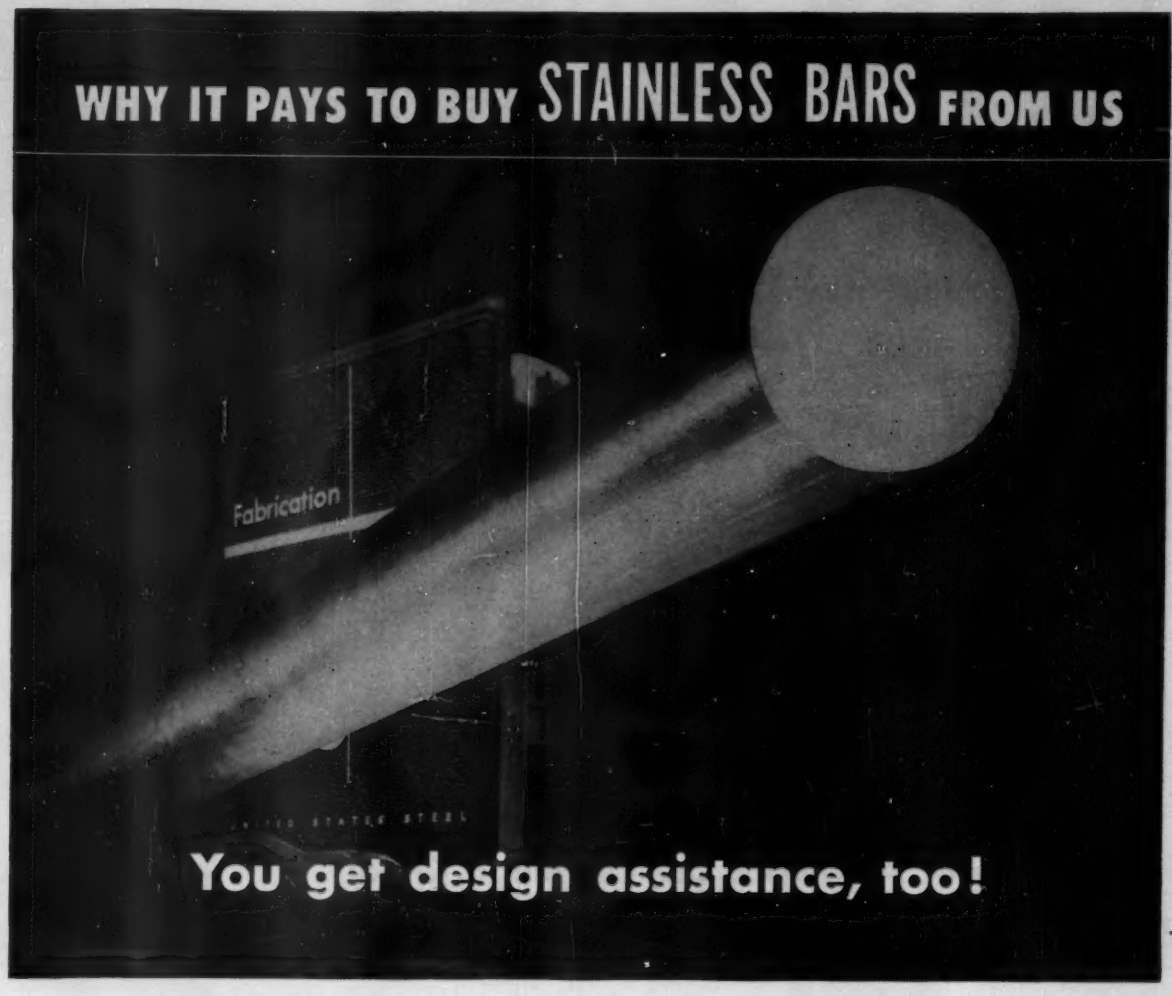
It pays to express yourself clearly. Say Air Express! Division of Railway Express Agency.

Air Express

GETS THERE FIRST *via U.S. Scheduled Airlines*

CALL AIR EXPRESS . . . *division of* RAILWAY EXPRESS AGENCY

WHY IT PAYS TO BUY STAINLESS BARS FROM US



TRIPLE SECURITY

What you want
When you want it
At the right price

ONE of our experienced stainless men will be glad to work with you on stainless steel selection problems so that you can use the most effective and economical grades and sizes. And we follow through from design to delivery to make sure that you get exactly the steel specified for the job. With complete stocks of dependable USS Stainless Steels, fast delivery service, and competent, thorough technical assistance, we offer a real cost-cutting combination.

Whatever your demands, it'll pay you to call on U. S. Steel Supply the next time you need stainless steel. Our unusually complete stocks of USS Stainless include bars—rounds, squares, hexagons, angles, channels, and the widest selection of grades, sizes and finishes of sheets and strip available.

For further information on stainless steel, just send us the coupon.

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U. S. Steel Supply
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Chicago 4, Ill.

Gentlemen:
Please send me, without obligation, your literature containing complete information on your Stainless Steel stocks and service.

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Company.....
Address.....
City.....State.....

For Atlantic Automatic Co., Cleveland, Ohio:

Tool Life Increased Over 200%!

PARTS FOR GEARS & CAR TRANSMISSIONS are just a few of the many delicate machine tool products Atlantic turns out. Cities Service Chillo Cutting Oil has helped Atlantic maintain their great reputation for quality products.

For the services of a Cities Service Lubrication Engineer... Write Cities Service Oil Company, Sixty Wall Tower, New York City 5, New York.

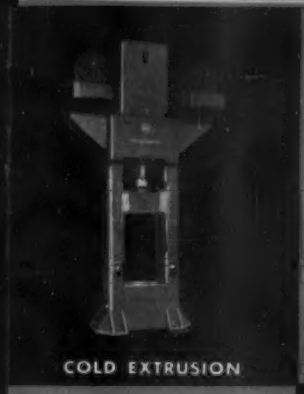
CITIES SERVICE
QUALITY PETROLEUM PRODUCTS

"Cities Service Chillo Cutting Oil Has Proved To Be The Difference Between Ordinary And Quality Production In Our Shop!"

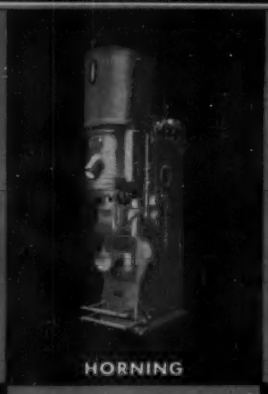
Here's Atlantic Automatic's story in their own words: "One of our tougher jobs recently was machining SAE 446 Stainless Steel with two forming, one threading and three drilling operations. The critical operation was drilling a .025 inch diameter hole, ⅛ inch deep. The drill would soon pack with chips and break. When a Cities Service Lubrication Engineer was called in, he recommended our using Chillo 44.

"This light-colored oil did the trick. DOWN TIME WAS CUT IN HALF AND DRILL LIFE INCREASED OVER 200%!

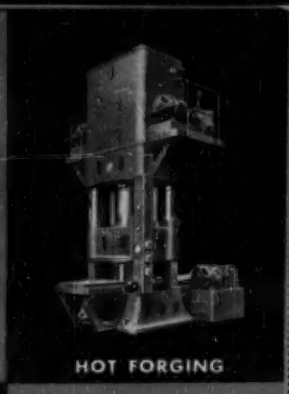
"We use Cities Service Chillo 44 to machine all types of metals covering a range of machinability from brass to stainless on our Brown and Sharpe 00G, 0G and 2G Automatics. It has proved to be the difference between ordinary and quality production in our shop!"


COLD EXTRUSION

FORMING

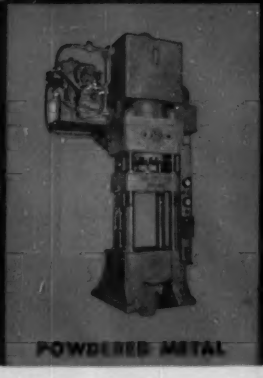

HORNING

DEEP DRAWING


HOT FORGING

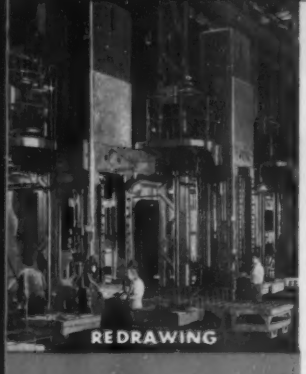
STRAIGHTENING

COINING


POWDERED METAL

RUBBER PAD

DIE SPOTTING


REDRAWING

There's a BLISS Hydraulic Press for practically every operation

and this 36-page catalog describes the entire line

The Bliss line of Hydro-Dynamic presses is one of the most complete available. Whether you are working with sheet, plate or powder—requiring single, double or triple actions, housing or open-rod frames, slides that move up or move down—Bliss has a hydraulic press for almost every operation.

See this complete line for yourself. It is thoroughly described and illustrated in our new 36-page brochure. Write today for your copy of Bulletin 30-A.

COLD FORGING

HOBBING

FORGING

BLISS
SINCE 1857

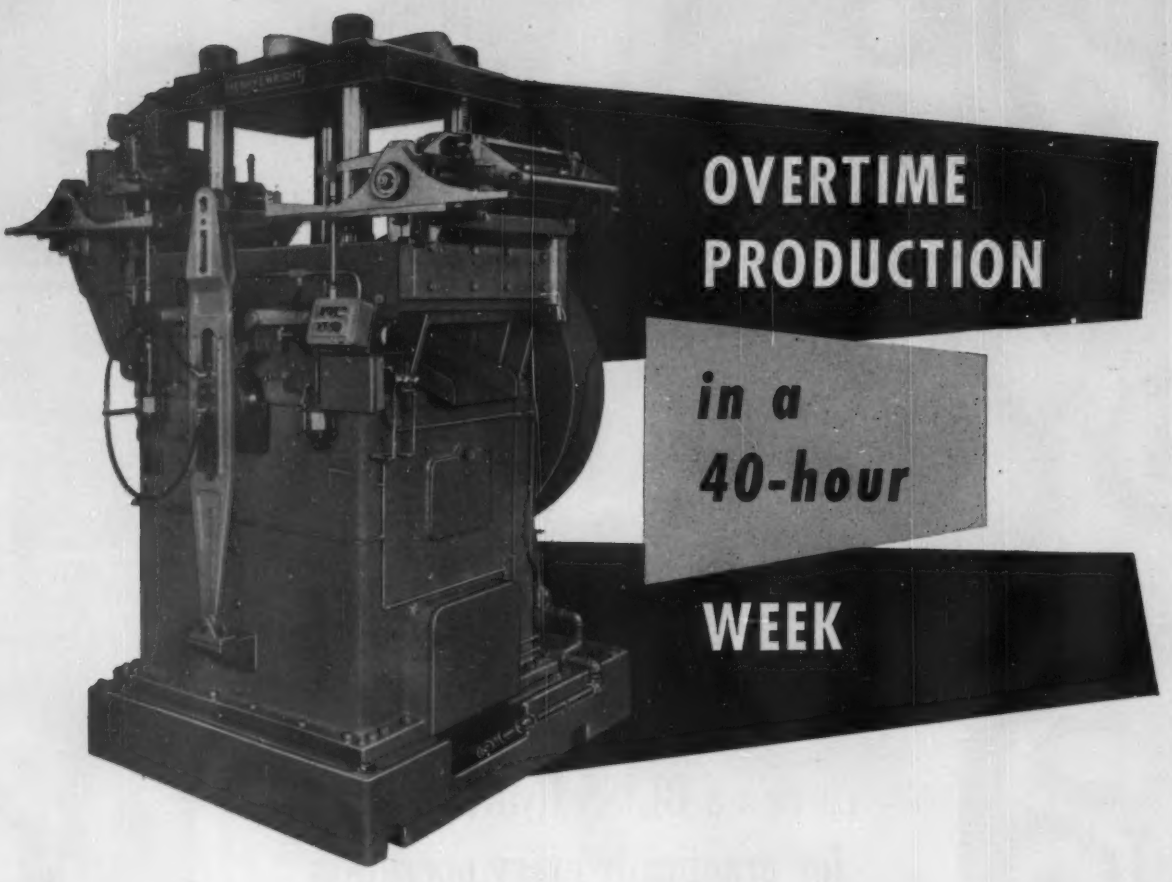
on your press is more than a name...it's a *guarantee*

E. W. BLISS COMPANY, Canton, Ohio

PRESSES, ROLLING MILLS, SPECIAL MACHINERY

Subsidiary: The Die Supply Company, Cleveland, O. • E. W. Bliss (England) Ltd., Derby • E. W. Bliss Company (Paris) France

U. S. Plants in Canton, Salem and Toledo, Ohio; Hastings, Michigan; and San Jose, Calif. *Branch Offices* in Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, Toledo; and Toronto, Canada. *West Coast Representatives:* Moore Machinery Co., Los Angeles and San Francisco; Star Machinery Company, Seattle. *Other representatives throughout the world.*



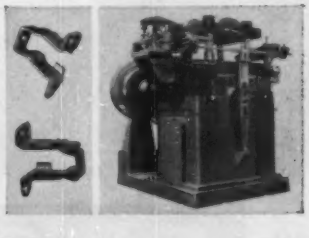
OVERTIME PRODUCTION in a 40-hour WEEK

If you have to produce more in a given time — the proven answer is a Henry & Wright Dieing Machine. Here is the capacity that enables you to keep pace with sudden scheduling changes; the consistent accuracy that permits you to set and automatically meet higher standards of work quality, while reducing cost.

In the Henry & Wright Dieing Machine, you have a production tool designed for high speed, built to widen radically the practical application of progressive stamping and engineered to prolong the life of your dies. Outstanding in its application for light and medium gauge metals, the Dieing Machine is also demonstrating that it can achieve equally extraordinary results in stamping and forming heavy gauge parts.

You owe it to yourself to include the Henry & Wright Dieing Machine in your plans for modernization, expansion or replacement. We welcome an opportunity to discuss its specific application to your requirements.

25-ton Henry & Wright Dieing Machines with twin die set-ups produced 435 parts per minute per machine at Barber-Colman.



200-ton Henry & Wright Dieing Machine producing 54 completed hinge boxes per minute from 3/32" x 13" steel in coil form.

ONE SET UP INSTEAD OF MANY WITH H&W DIEING MACHINES

HELPFUL DATA *is available in our fact-packed catalog which you can have by writing Henry & Wright, 481 Windsor St., Hartford, Connecticut.*

HENRY & WRIGHT

DIVISION OF EMHART MFG. CO.

HARTFORD, CONNECTICUT

INSTALL WIREWAYS FASTER!

SQUARE D's NEW AND EXCLUSIVE *Lay-in Duct*

FASTER ASSEMBLY!
LESS NUTS AND BOLTS
FASTER WIRING!
NO MORE THREADING OR PULLING OF CONDUCTORS...JUST LAY THEM IN
FASTER HANGING!
UNIVERSAL TYPE HANGERS
FASTER GANGING!
KNOCKOUTS MATCH THOSE ON RELATED SQUARE D EQUIPMENT. NO CONDUIT BENDING

Square D's exclusive design provides hinged covers for both the duct sections and connectors. Easily removable fitting covers then provide a completely unobstructed wireway in which to lay wires.

LAY-IN DUCT is available in 2½" x 2½", 4" x 4", and 6" x 6" sizes, in standard lengths of 1, 2, and 5 feet. There is a complete line of fittings, all with the "lay-in" design feature.

• • •

Write for the complete story of LAY-IN DUCT—how it gives you a better wireway system, easier, faster and at less cost. Address Square D Company, 6060 Rivard Street, Detroit 11, Michigan.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

Carlton *Only one*

Carlton's exclusive 3-unit power-operated mechanical clamping of arm, head and column is easier, faster and costs less to operate

ELECTRO-HYDRAULIC POWER is used to actuate mechanical clamping devices on arm, head and column of Carlton radials. Once any of these units is clamped or unclamped, mechanical devices hold them in position until the electro-hydraulic power is applied again.

Electric power is used only when clamping or unclamping . . . results in noticeable savings in electric power consumption.

The hydraulic pressure required in Carlton electro-hydraulic clamping systems is comparatively low . . . so that there is positively no leakage of oil from any unit. Each unit has its own individual oil reservoir . . . and the oil from the Arm reservoir is used to lubricate the Column.

Due to the use of electrical interlocking, overload relays and safety valves, it is impossible to overload Carlton electro-hydraulic clamping systems either electrically or mechanically.

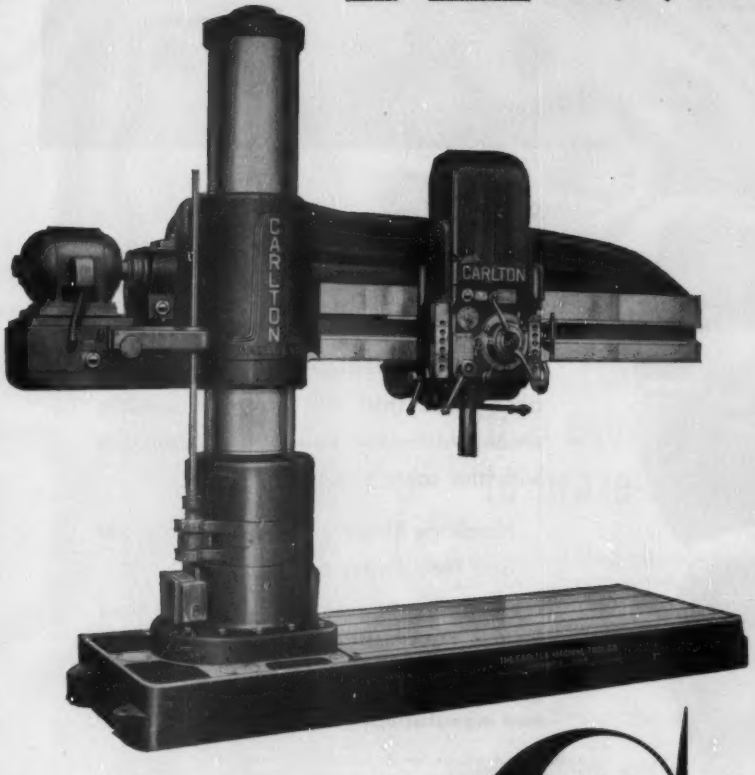
column clamp...arm clamp...head clamp

can be called

the finest...

CENTRALIZED CONTROLS:
All controls necessary for quickly and accurately locating the drill from one hole to the next are centralized at the head . . . all located within the spread of a man's hand.

only Carlton brings you all three radial drill advantages:



- **CENTRALIZED CONTROLS** (see above).
- **3-UNIT POWER CLAMPING:** column, arm, head (see opposite page).
- **LOW HUNG DRIVE** . . . drives on largest diameter of the spindle . . . permits maximum torq transmission with a minimum of spindle twist.
- **FREE AND EASY RUNNING** . . . thanks to the generous use of tapered and straight roller bearings and ball bearings.
- **EASY TO MAINTAIN** . . . parts jig machined for absolute interchangeability.
- **THE RIGHT RADIAL** for you: select your Carlton from among 5 models, 26 different arm and column sizes. Why not send for descriptive bulletins today?

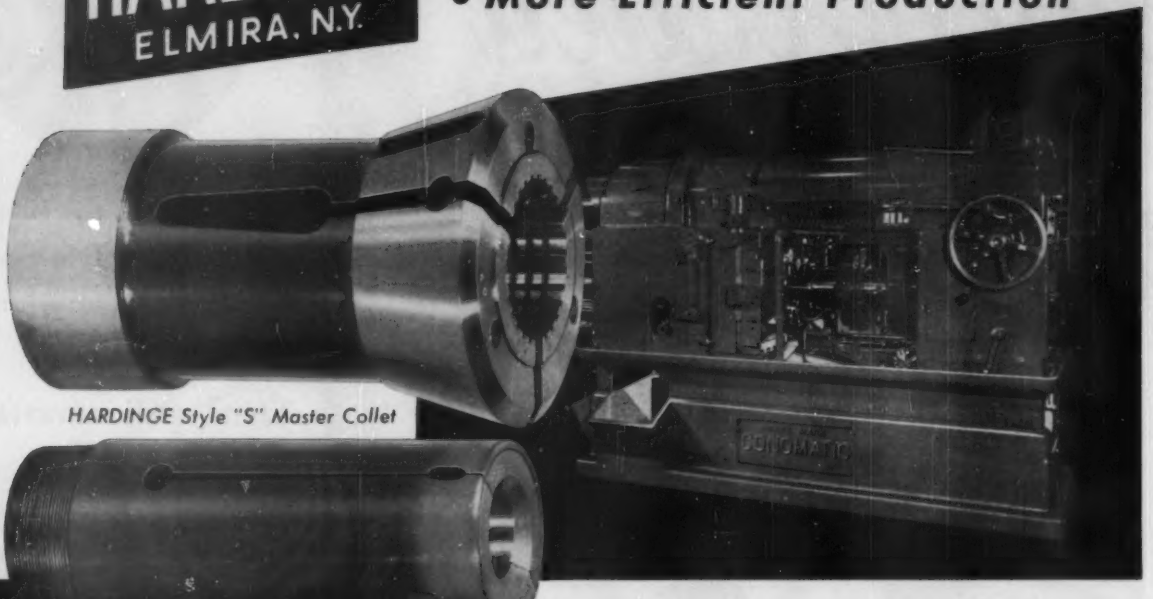
Carlton

THE CARLTON MACHINE TOOL CO., CINCINNATI 25, OHIO

HARDINGE COLLETS and FEED FINGERS
for Cone Automatics*

HARDINGE
ELMIRA, N.Y.

- *Low Tooling Cost*
- *More Efficient Production*



HARDINGE Style "S" Master Collet

HARDINGE Style "B" Master Feed Finger

HARDINGE Regular Collet

HARDINGE Regular Feed Finger

Immediate Stock Delivery
from Hartford
New York Philadelphia
Dayton Chicago
Minneapolis St. Louis
Detroit San Francisco
Los Angeles Elmira

Maximum production at lowest cost is assured when you specify HARDINGE Collets and Feed Fingers

Hardinge Master Collets and Master Feed Fingers feature low-cost replaceable pads that are interchangeable among different makes of automatics with the same capacity.

Hardinge Masters give true solid collet and feed finger performance.

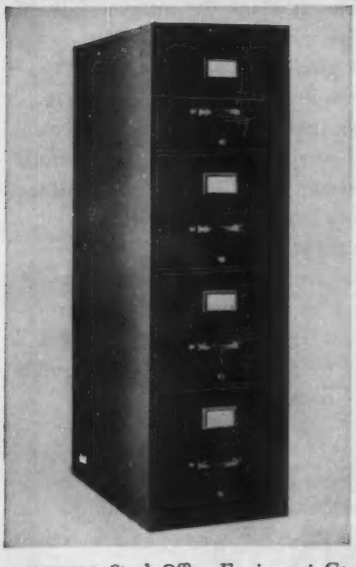
Hardinge Regular Collets and Feed Fingers are precision made, hardened and ground internally and externally, and bring you the benefit of 62 years of engineering and manufacturing experience.

* *Also available for the following automatics: Greenlee, Gridley and Acme-Gridley, National Acme, New Britain*

Hardinge is your <u>one</u> source of supply for all collets and feed fingers.

HARDINGE BROTHERS, INC.
ELMIRA, N. Y.

STRONG JOINT on desk housing is made with Tobin Bronze Welding Rod.



COLUMBIA Steel Office Equipment Co. also produces attractive filing cabinets like this one by braze-welding with Tobin Bronze Welding Rod.

Office equipment maker uses Tobin Bronze to braze-weld stronger, cleaner joints

On desks and filing cabinets it's important that all corner joints have adequate rigidity and strength, and that they look clean and neat after enamel finishing. Whether they will or not depends largely on the welds at these points.

Columbia Steel Office Equipment Co., Philadelphia, has this problem licked. First, they spot-weld all desks and filing cabinets. Then, units are braze-welded with Tobin Bronze* Welding Rods (3/32 in.). Columbia says, "Braze-welding with Tobin Bronze provides greater strength at the joints . . . helps to make our equipment more attractive. Our work goes faster, too. Tobin Bronze flows freely, 'tins' quickly, gives strong, neat bonds. Braze-welding with Tobin Bronze is the fastest, most economical way we've found to do the job."

ANACONDA Welding Rods for many types of production and repair jobs are available from distributors throughout the United States. *The American Brass Company, Waterbury 20, Conn.* In Canada: *Anaconda American Brass Ltd., New Toronto, Ont.* 54198

*Reg. U. S. Pat. Off.

ANACONDA®

Welding Rods

Anaconda Copper-372 • Tobin Bronze-481 • Anaconda-997 (Low Fuming) Bronze • Nickel Silver-828 • Cupro Nickel-826 • Everdur-1010 • Ambraloy-928 • Phosphor Bronze-351 • Phosphor Bronze-354.

copied but not duplicated

...and REX is the original high speed steel by which all others are judged

Great works of art clearly show the unique skills of their maker. Even the most careful copy can never truly duplicate the original.

Crucible REX® High Speed Steels are *originals*, too. Ever since 1900, when the Country's leading tool steel specialists combined their knowledge and formed Crucible, we have lavished on tool steel making all the skill and care that goes into any work of art.

That's why REX is the standard of comparison wherever high speed steels are used. But see for yourself. Put REX to work in your shop . . . check its hardenability, response to heat treatment, general quality and fine tool performance. We feel sure that, like thousands of others, you'll come back for more.

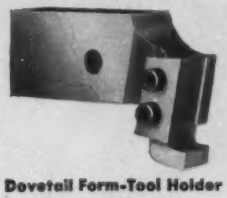
CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **TOOL STEELS**

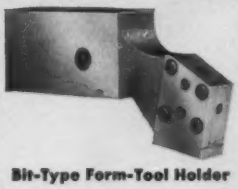
CRUCIBLE STEEL COMPANY OF AMERICA · TOOL STEEL SALES · SYRACUSE, N. Y.

GREENLEE *Automatics*

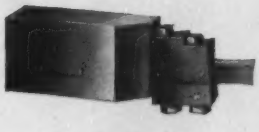
Circular Form-Tool Holder



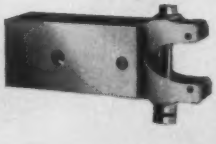
Dovetail Form-Tool Holder



Bit-Type Form-Tool Holder



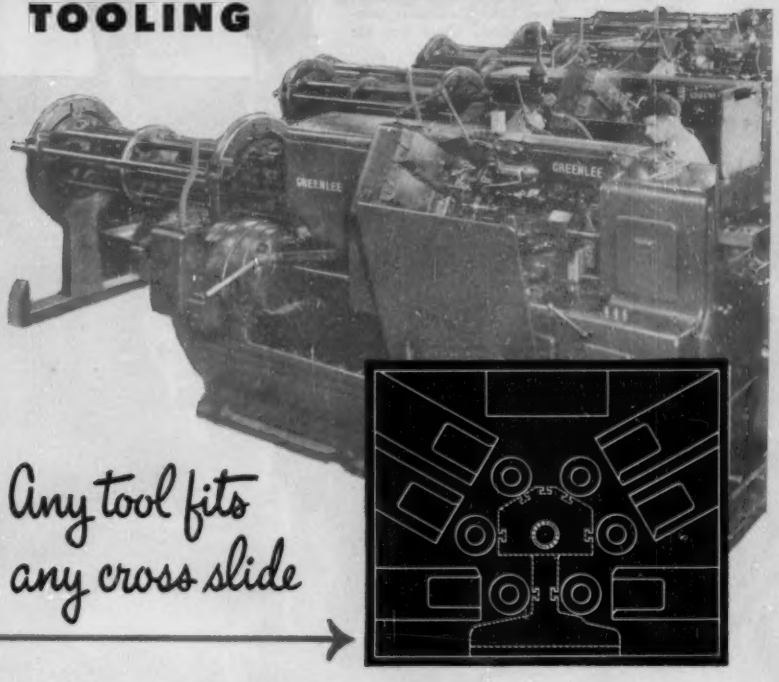
Cut-Off Tool Holder



Knurling Tool Holder

Stencilling Wheel Holder

INTERCHANGEABLE TOOLING



Any tool fits any cross slide

SAVE TIME AND MONEY REDUCE JOB COSTS

Among the cost-saving features of Greenlee Automatics, one of the most advantageous is the arrangement whereby *any* of various standardized tool holders will fit in *any* of the six cross-slides. This means not only no limitations as to what tools can be used in which positions, but also a minimum requirement for investment in tools, and a maximum of speed in tool setting when changing over between jobs. *You can profit* from this and the many other outstanding features of Greenlee Automatics.

Write for FREE Literature

Send today for your copy of our 20-page booklet describing and illustrating all the Greenlee features.

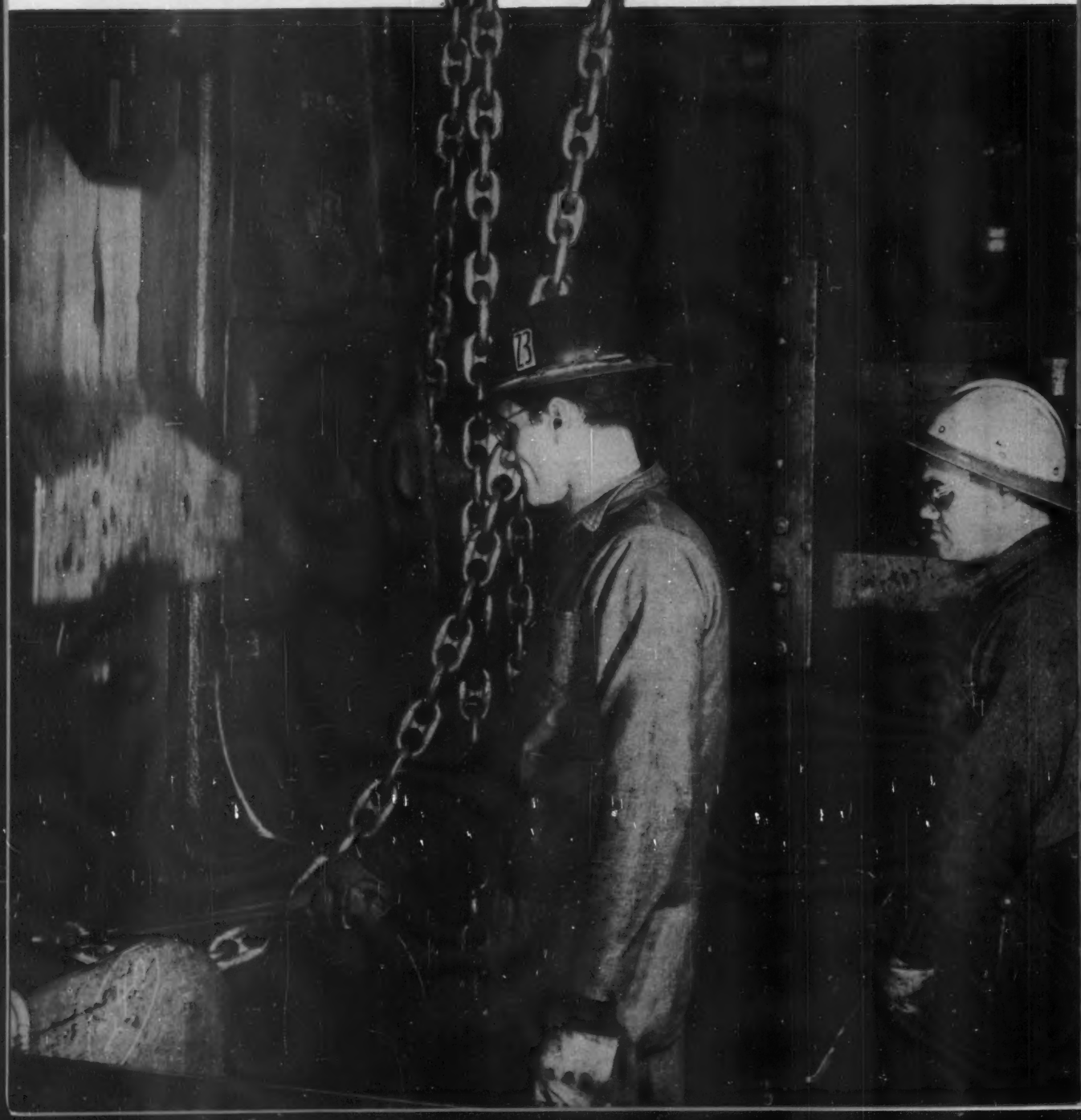
PRODUCTION MACHINERY

GREENLEE

GREENLEE BROS. & CO.
1724 MASON AVE., ROCKFORD, ILL.

Special non-magnetic anchors the

NON-MAGNETIC ANCHOR CHAINS are forged by Baldt Anchor, Chain and Forge Division of The Boston Metals Company, Chester, Pa., from USS CARILLOY austenitic manganese steel. They are air cooled after forging.



USS Carilloy steel chain
Navy's newest minesweeper

THE United States Navy has made minesweeping operations more effective with the help of USS CARILLOY steel.

During World War II, a new weapon in marine warfare was developed—the magnetic mine. These mines explode when a ship made of magnetic steel comes near. To sweep such mines safely, without premature or uncontrolled explosion, the Navy is building a fleet of radically new *nonmagnetic* minesweepers.

Finding a suitable steel for the anchor chains on these ships was quite a problem. The chains scrape over hard rocks, sand, and coral along the ocean floor, so they must have good resistance to abrasion. In addition, they must withstand heavy tension, torsion, and impact stresses as wind and tide pound at the ship. To top it off, they must be nonmagnetic and must maintain the non-magnetic feature even after cold working and stressing.

The Navy satisfied *all* these tough requirements with CARILLOY austenitic manganese steel. Intimate knowledge of steels and accurate, skillful control of each step in steel making enabled us to meet the unusual specifications.

Experience on extraordinary jobs like this helps us to do a better job on your steel, whether you need a standard AISI grade or a special analysis. When you need high-quality alloy steel, specify USS CARILLOY. And when you need expert metallurgical advice, get in touch with the nearest USS District Sales Office.

LENGTH of this ¾" anchor chain is checked after proof test loading at Boston Naval Shipyard. Ductility is extremely important in these chains, and USS CARILLOY steel provides an elongation of 80%.

UNITED STATES STEEL CORPORATION, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Carilloy USS Steels

ELECTRIC FURNACE OR OPEN HEARTH

COMPLETE PRODUCTION FACILITIES IN CHICAGO OR PITTSBURGH

4-1057

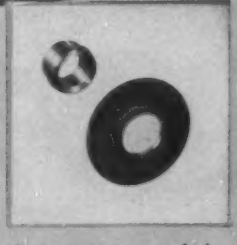
UNITED STATES STEEL

How the design, development and production team at Burgess-Norton made possible

Cost Savings of 17% On this Clutch Hub

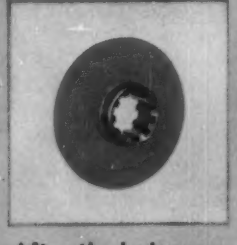
Here is another example of how redesign for modern production methods produced a better part at lower costs. This clutch hub was formerly made from a machined forging. By combining a screw machined part and a stamping through hydrogen-copper brazing, as shown below, production costs were reduced 17% . . . greater control on flange tolerances obtained, and eight stop lugs could be used instead of only four.

The original forged hub design required greater machining time, and often had excessive scrap because of flange thickness variations.

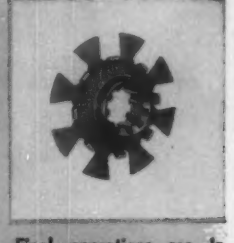


Basic components of the new design are a stamped and formed flange and a screw machined center hub.

The two parts are then assembled with copper rings and brazed under controlled atmosphere conditions to eliminate oxidation.



After the hydrogen-copper brazing operation, the hub splines are cut on horizontal broaching machines.



Final operations are in the stamping department, where spring slots are pierced and stop lugs formed.

COMPLETE FACILITIES
FROM DESIGN THROUGH PRODUCTION FOR BETTER PARTS AT LOWER COSTS

Engineering is one of the important cogs in the complete service offered to industry by B-N. This experienced group works closely with production and metallurgy in designing for low cost manufacture and better end-use performance.

Burgess-Norton facilities and equipment are extremely diversified for the economical production of a wide range of precision parts, and include complete engineering, development, and metallurgy departments. This engineering service is available to you without obligation. If you have a parts production problem, we believe it will pay you to check into Burgess-Norton facilities. Send prints, specifications, or samples . . . or, if you prefer, one of our sales engineers will call, at your convenience.

BURGESS-NORTON MFG. CO.

GENEVA, ILLINOIS

Serving Industry For Over 50 Years

Production Pointers from GISHOLT

GISHOLT TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help you cut time and costs in your own work.

TWO OPERATIONS ON ONE MACHINE...WITH ONE SETUP

Fastermatic Double-Chucks Part

This is a bit tricky, but note how these couplings are produced without tying up two machines or running up increased costs through needless changeover time.

The part requires two machining operations; two chuckings. The problem of how to do it on one machine using *one* tool setup was solved with a 2F Fastermatic Automatic Turret Lathe.

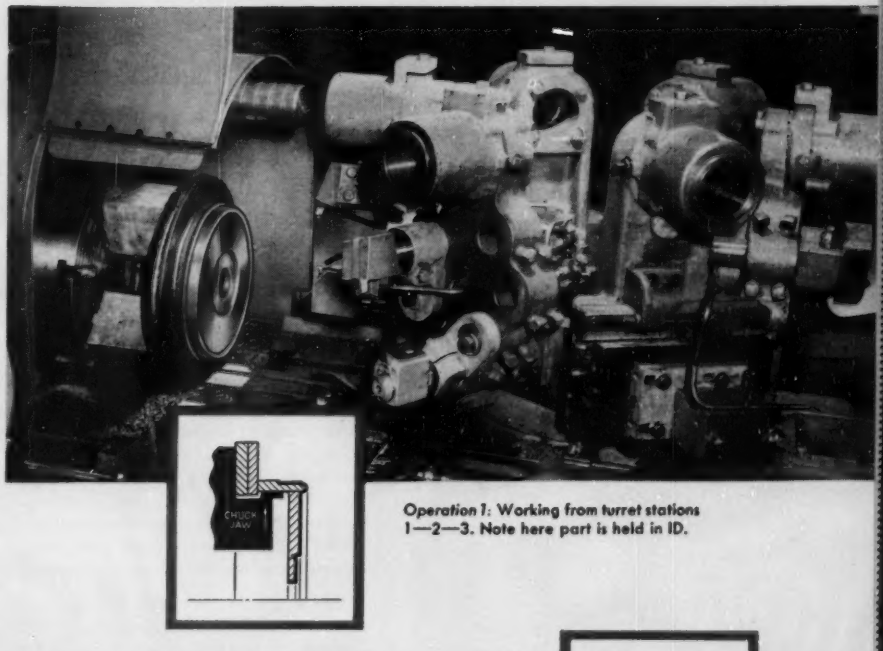
Here's how:

Operation 1—this consists of turning, facing, boring and chamfering from turret stations 1—2—3. The part is held in the ID with an air chuck. With this automatic cycle completed, the spindle stops and the workpiece is turned around and rechucked in the same jaws—except that now they hold on the OD.

Second Operation—the machine is started and automatically goes through the new machining cycle. Turret stations 4—5—6 rough and finish face on the other side, completing the part.

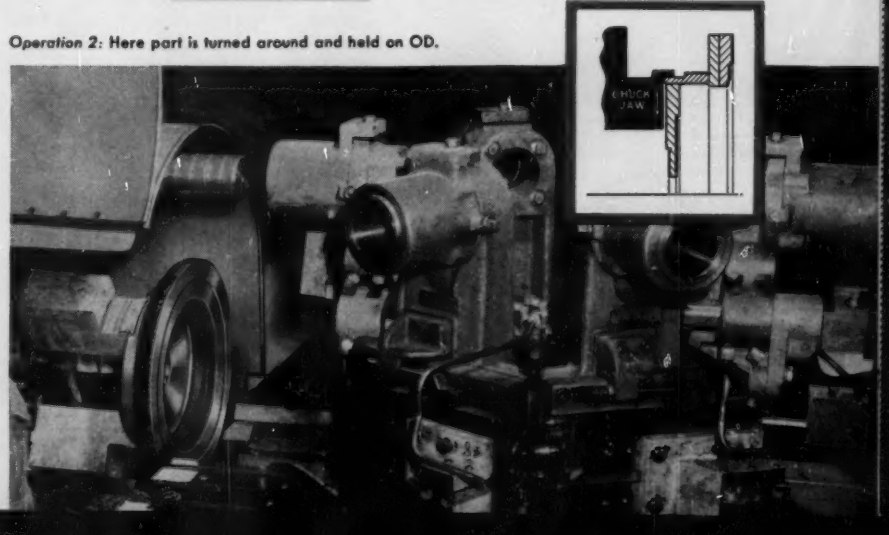
Obviously, this single-tooled, switch-around idea is not applicable in many cases. Yet, it is worth remembering. And so is the unusual versatility of the Fastermatic Automatic Turret Lathe which can account for reduced machining time and costs on many jobs.

The Fastermatic Automatic Turret Lathe does this unusual job easily and fast with both operations handled in one setup.



Operation 1: Working from turret stations 1—2—3. Note here part is held in ID.

Operation 2: Here part is turned around and held on OD.



TIME-SAVING IDEAS

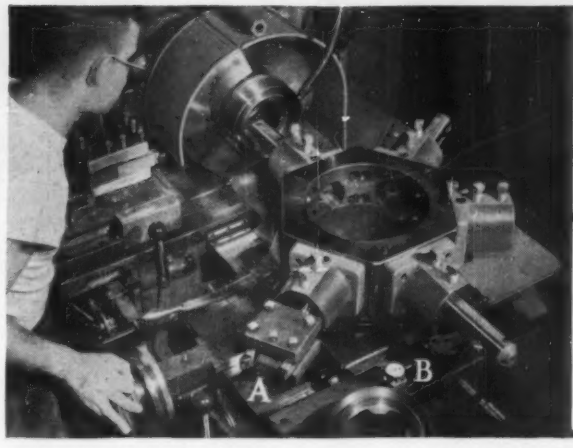
REDUCING TOOL COSTS ON DOUBLE-OPERATION WORK

C/F Turret Permits Simpler Tooling on Saddle Type Lathe

Here's a case where the producer wanted to handle first and second operations on one machine and do it with the simplest, most inexpensive possible tooling. The part is a 7½" commutator clamp. A Gisholt 1L Saddle Type Turret Lathe was given the job because there is considerable stock removal... and because it could be equipped with a cross-feeding hexagon turret to simplify tooling.

The drawing shows the surfaces machined in the two operations. Short flanged tool holders on the hexagon turret permit changeover in just minutes. The photo shows the setup for the second operation. Note the standard turret tool holder (A) which holds two cutters to finish the two faces of the outer rim. The cross-feeding turret handles both in one pass. This saves time and it insures dimensional accuracy.

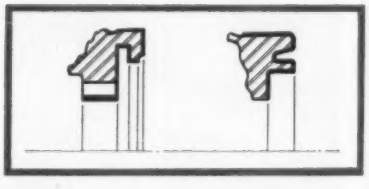
One bore has a particularly critical diameter. Setting the hexagon turret cross slide with the dial indicator (B) insures the precise dimension.

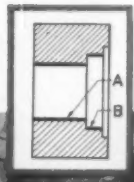


Machine view showing second operation.

Finished piece, first and second operation.

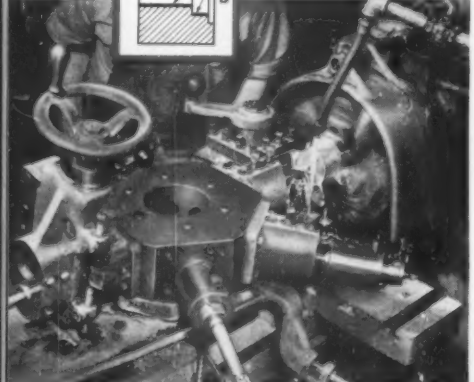
Another example of how the cross-feeding turret on the Gisholt Saddle Type Turret Lathe can save time and reduce tooling costs on a variety of work.





A SIMPLE JOB MADE EVEN SIMPLER

Quick Change of Spindle Speeds Saves Time, Effort, Money

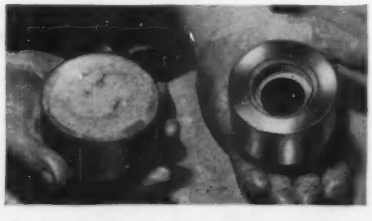


Working at 402 r.p.m., the operator will get reaming speed by merely tapping the HI-LO lever, shown below.

This would be a simple enough job in any shop. But here, the important differences in time and effort show up with the operation of the ram type machine. With the No. 5 Ram Type Turret Lathe, equipped with the Gisholt Hydraulic Speed Selector and HI-LO Trip Lever, time and effort are reduced to the barest minimum.

The reasons: (A) is first drilled and then bored from the hexagon turret. This work is done at 402 r.p.m. Then reaming is done. Here, with most machines, the operator would have to shift headstock gears to the new and lower spindle speed. With the Gisholt No. 5 Ram Type Turret Lathe, the operator just taps the HI-LO lever. Instantly the Hydraulic Speed Selector makes the shift. Even before the reamer is in working position, the spindle is turning at the correct speed—69 r.p.m. in this case.

Once the reaming is done, the operator again trips the HI-LO lever; and while the turret is indexing, the Hydraulic Speed Selector automatically makes the shift back to 402 r.p.m. Then counterbore (B) is started.



Rough workpiece and completed part.

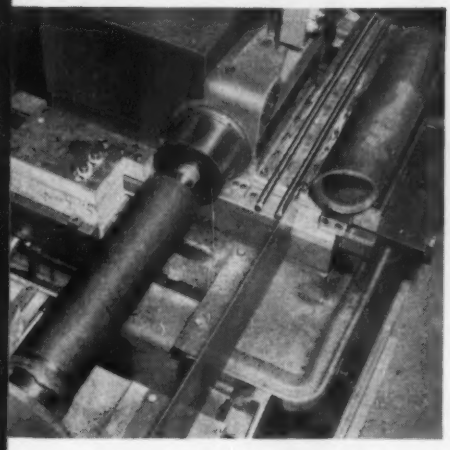
The Gisholt Hydraulic Speed Selector not only saves time and physical effort in changing speeds, but it also reduces floor-to-floor time. That's another good way to cut costs.

GISHOLT

TIME-SAVING IDEAS

SMART LOADING METHODS LIKE THIS WILL SAVE YOU TIME

Simplimatic Automatic Lathe Uses Slide to Aid Handling



With part completed, it is moved out on the rails and then onto the conveyor lines. New workpiece then is rolled onto the rails and pushed on arbor. Sketch below shows complete sequence.

This was not a matter of faster cutting, but faster "handling time." The workpiece is a 155 mm steel shell body. The machine is the Simplimatic Automatic Lathe. The job itself is simple: face down to the boss and cut off to length.

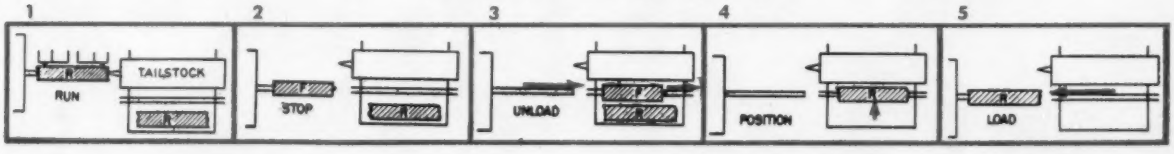
Most interesting is the expert work-handling method—a simple device that greatly increases machine use and hourly production by reducing loading and unloading time.

Step by step, the job goes like this: the slide with tailstock is retracted. Rails mounted on the slide guide the rough workpiece as it is loaded on the arbor. The slide then moves forward and the tailstock quill supports the work.

While the rear tools make chips, the operator places a new rough workpiece on the ramp at the front of the slide. With machining completed, the tailstock quill automatically retracts and the slide moves back. The finished part is moved off the arbor onto the rails and then to a conveyor line. Onto the rails goes the waiting rough workpiece and then on the arbor. The tailstock slide comes into position; the next piece is begun.

This job could easily take 20% to 40% longer without this efficient handling arrangement—even with the same machining time. Gisholt engineers have had extensive experience in solving loading problems. Let them help save time on your jobs of this kind.

The tailstock slide on this Simplimatic also carries loading-unloading rails which quickly position the work and ease the manual burden.



ALUMINUM IMPELLERS GET FAST MACHINING

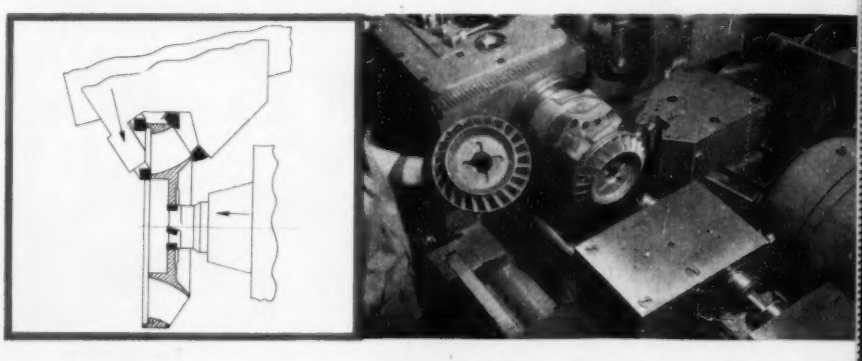
No. 12 Hydraulic Automatic Lathe does it in 10 Seconds

Split-second efficiency is a must on this job—machining operations on two different impellers for a popular car's automatic transmission. While the work is small, the volume is great. So, every second counts.

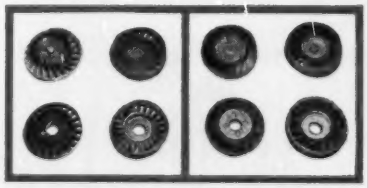
Only one No. 12 Hydraulic Automatic Lathe is needed to handle the entire output. With the workpiece located in the 3-jaw air chuck, the spindle is driven at 900 r.p.m. The workpiece center is then removed by trepanning under oil mist lubrication. A speeder drives the trepanning cutter by means of a sliding sleeve arrangement on the front carriage. Longitudinal carriage movement carries the cutter to and from the work, allowing clearance for loading.

The balance of the work is done with four tools in a single tool block on the rear slide. This slide moves in at an angle so that both back faces may be shaved at once.

Time is just ten seconds floor-to-floor. The No. 12 Hydraulic Automatic Lathe performs with speed and economy on all jobs working with all metals. It can give you the high production and low cost you want in your work.



The flexibility of the No. 12 Hydraulic Automatic Lathe permits the kind of tooling which reduces this job to only two simultaneous straight-line motions.



Top panels show both sides of rough parts; the completed parts are below.

Write for complete catalog of No. 12 Hydraulic Automatic Lathe.

GISHOLT

TIME-SAVING IDEAS

CYLINDRICAL PARTS BALANCED IN OVERHANGING POSITION

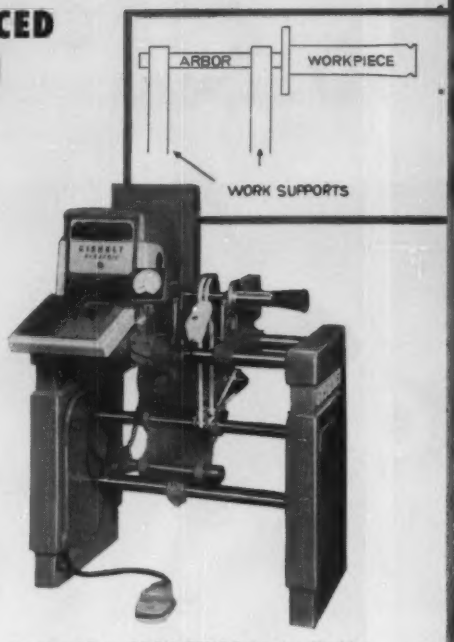
Improved 1S DYNETRIC Balancer Simplifies and Speeds up Two-Plane Balancing

The spinners used in textile mills must be dynamically balanced because of their high-speed rotation. Here, a rayon spinner, a workpiece typical of those which do not carry their own shaft, is being balanced on the Gisholt improved type 1S DYNETRIC Balancing Machine. The spinner is mounted on an arbor and balanced in an overhanging position. This simplifies loading and unloading since the arbor is not removed from the work supports. Simple left or right switches simultaneously indicate the location and amount of material to be removed in each correction plane. Correction is made after removal from the arbor. Production balancing of overhanging workpieces such as this is a simple operation on Gisholt Balancing Machines. Unbalance is quickly and accurately measured and located for correction.

The machine-mounted arbor permits balancing of overhanging parts and speeds up loading and unloading.

NEW CATALOG covers the improved and more complete line of Type S DYNETRIC Balancing Machines. It has full information and illustrates many interesting jobs. Write for your copy.

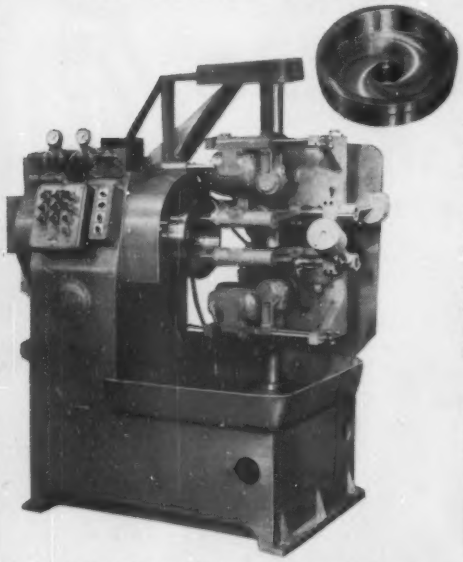
DYNETRIC BALANCERS GISHOLT



Improved Type 1S DYNETRIC Balancing Machine with loaded workpiece. Drawing shows permanently mounted arbor on work supports.

AIR CYLINDERS GREATLY IMPROVED BY SUPERFINISHING

ID Surface Handled in One Quick, Automatic Operation

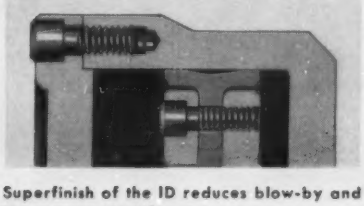


Model 79 Superfinisher showing stone holders in working position. Above, part ID is Superfinished; reflections are from true base metal.

This is one of our own applications of Superfinish. The part is the air cylinder used with Gisholt air-operated chucks.

To give maximum efficiency to these cylinders, we turned to the practical expedient of Superfinishing. The result is an ID surface that allows far less blow-by, and that greatly extends packing life. At first the parts were Superfinished in our Superfinishing laboratory. Then, to do the job on a production basis, a special automatic machine was designed, the Model 79 Superfinisher. It has large capacity with variable speeds and oscillation rates. For rapid loading and unloading, it is equipped with an air chuck.

In one fast, automatic operation all Gisholt air cylinders are Superfinished to make them better performing, longer serving.



Superfinish of the ID reduces blow-by and increases packing life.

SURFACE FINISH—its problems and how they are overcome by Superfinishing are fully covered in new catalog. Write for your copy now.

No. 3-454

624

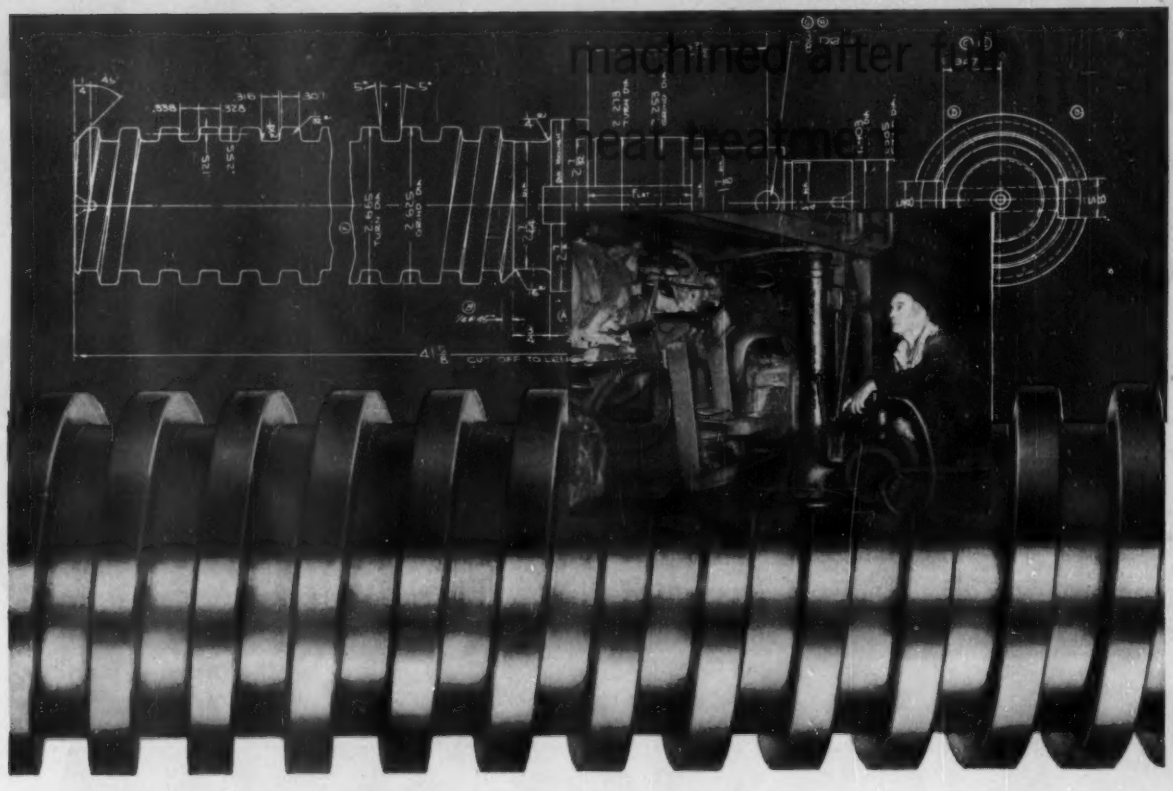
THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

Write for your copy of Gisholt's new general catalog.

GISHOLT MACHINE COMPANY Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

MAX-EL alloy steel part for 100-ton jack



The Max-el part shown above is the lifting screw from a Duff-Norton air motor screw jack. It's the part that actually lifts and holds the load . . . up to 100 tons.

To make the part, blanks are cut from Max-el 3½ bar stock. After heat treating to 321-341 Brinell, threads are chased and all machining performed. Max-el's optimum machinability after heat treatment, its high-strength, toughness, deep hardenability — which prevents thread sinkage, and high surface finish make it an ideal choice for this rugged application.

But try Max-el yourself. Its excellent machinability means longer tool life, more pieces per grind. And you'll appreciate its freedom from distortion and superior quality. For immediate delivery of Max-el call your nearest Crucible representative.

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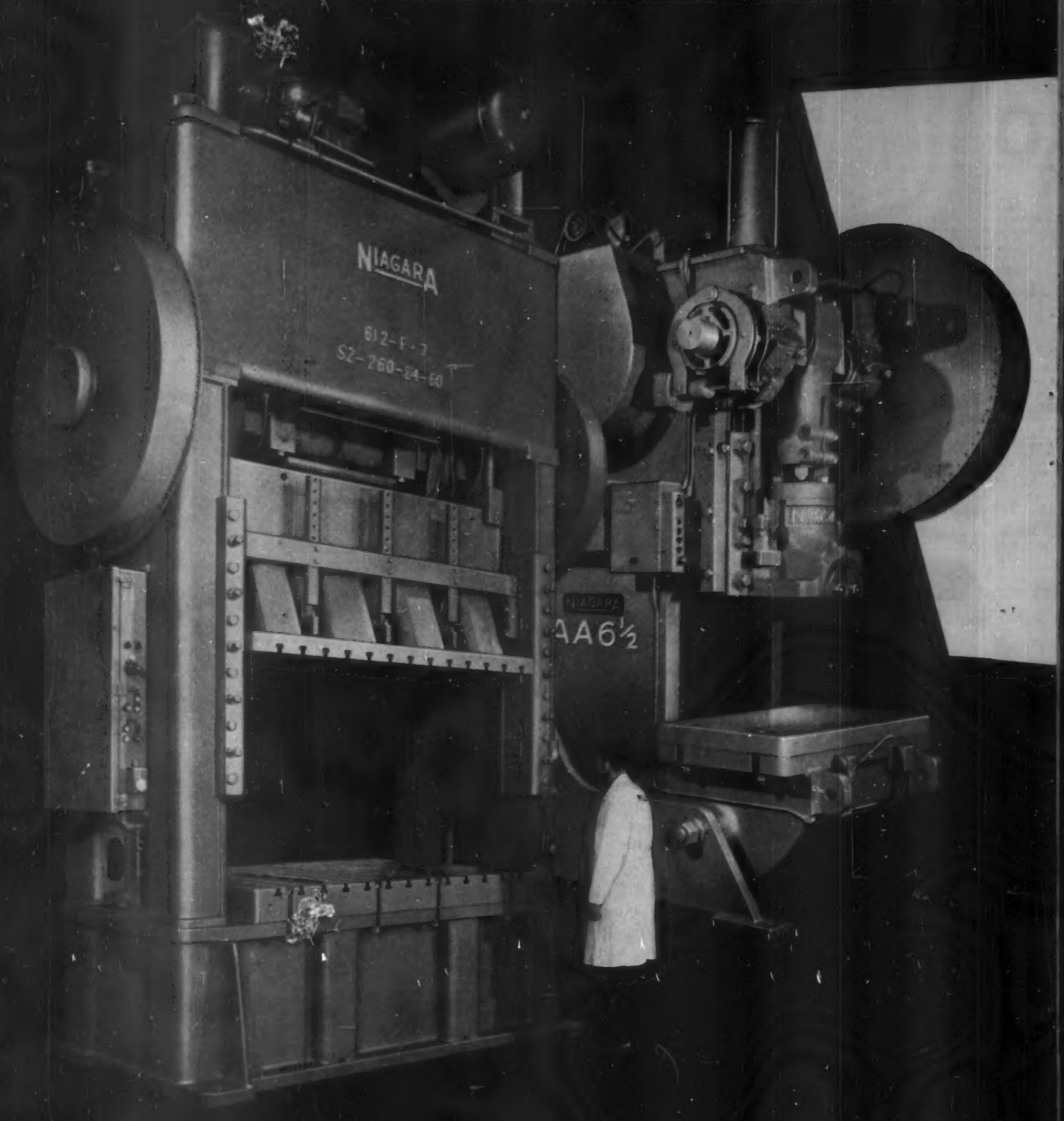

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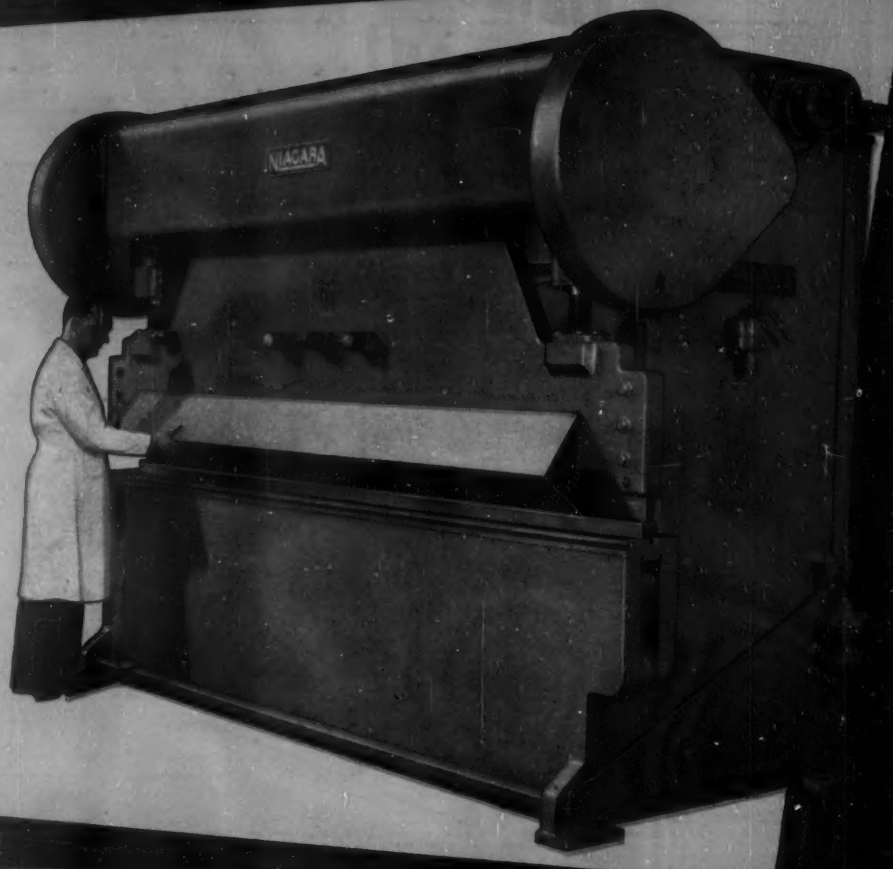

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LODGE & SHIPLEY POWER and RIGIDITY FOR THE HEAVIEST CUTS

. . . precision for the most exacting work!

This gigantic Model X 32" Standard Lathe, 30 feet between centers, will have vital use in the defense effort at a large California arsenal.

Whether for defense or civilian production, preference for Lodge & Shipley Lathes is easily understood. The latest in money-making and saving features are incorporated in these lathes: higher speeds, greater horsepower and all-round ruggedness permit the application of the most modern tooling.

Whether used in production, tooling or maintenance, only the most modern lathes . . . LODGE & SHIPLEY . . . can be truly profitable producers. Write for detailed literature.

THE **Lodge & Shipley** COMPANY

CINCINNATI 25, OHIO

ENGINE, TOOLMAKER, MANUFACTURING, GAP AND OIL COUNTRY MODEL "X" LATHES, COPYMATIC, DUOMATIC and T-LATHES.

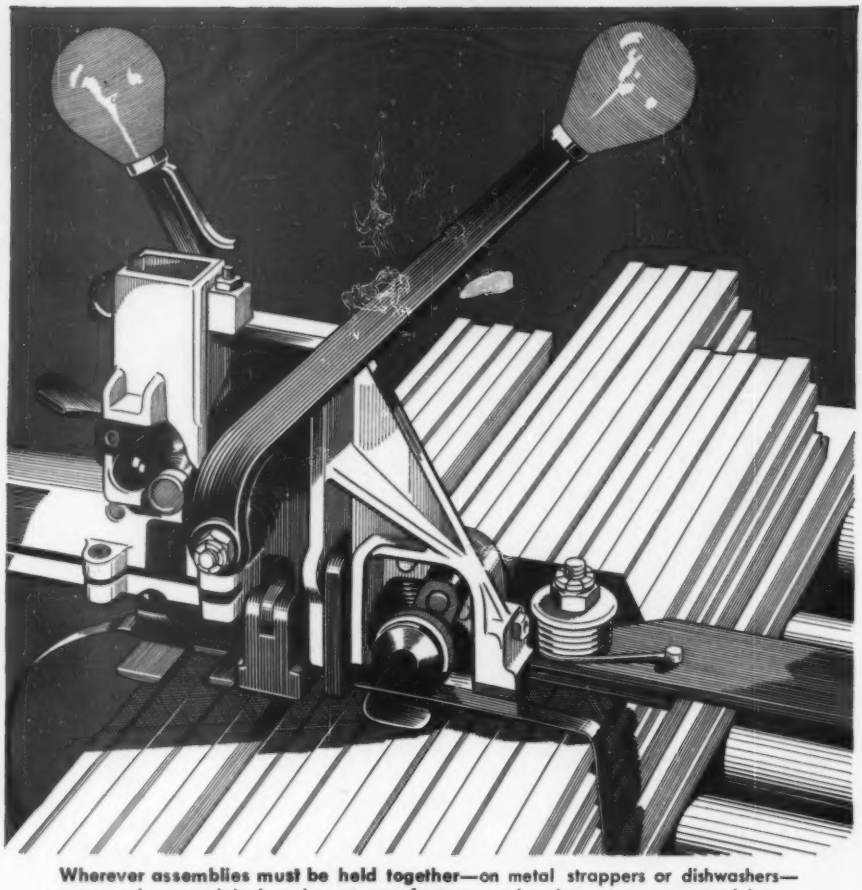
HAMMER FORGED *plus* POLISHED FLUTES

This hammer forged drill (a GTD-AMPCO exclusive) even without polished flutes would still be a superior drill! Polishing the flutes, which means improved chip slippage, reduced friction heat and a tendency to reduce power consumption, give it still *another* plus value. All this at no extra cost to you!

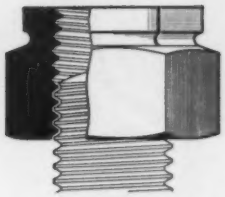
AMPCO TWIST DRILL DIVISION

GREENFIELD TAP AND DIE CORPORATION

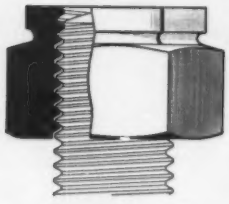
GREENFIELD, MASS.



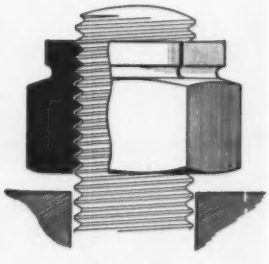
Wherever assemblies must be held together—on metal strappers or dishwashers—more and more original equipment manufacturers and maintenance men are relying on FLEXLOC locknuts for safe, dependable locking.



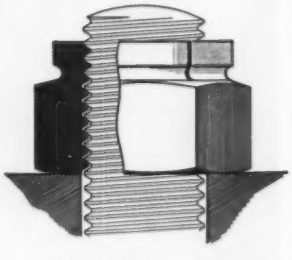
Starting. A FLEXLOC starts like any ordinary nut. Put it on with your fingers. Tighten it with a standard hand or speed wrench.



Beginning to Lock. As the bolt enters the segmented locking section, the section is expanded, and the nut starts to lock.



Fully Locked As a Stop Nut. When 1½ threads of a standard bolt are past the top of the nut, the FLEXLOC is fully locked. A FLEXLOC does not have to seat to lock.



Fully Locked As a Seated Nut. When it is used as a lock or stop nut, the locking threads of the FLEXLOC press inward against the bolt, lifting the nut upward and causing the remaining threads to bear against the lower surface of the bolt threads. Vibration will not loosen a FLEXLOC, yet there is no galling of threads.

Why are more and more FLEXLOC locknuts being used to hold assemblies together?

There are a number of reasons. FLEXLOCs are one piece, all metal—no lockwashers to break, no cotter pins to shear, no auxiliary locking devices to deteriorate. FLEXLOCs stay put wherever you place them—as stop nuts or seated nuts—once their locking threads are fully engaged. Because they won't work loose, they reduce costly service calls. FLEXLOCs have higher tensile, are stronger than most other locknuts. And they withstand temperatures as high as 550°F.

FLEXLOCs have the additional advantage of reusability. They can be applied again and again without loss of efficiency. Because they are safe and dependable, you'll find more and more FLEXLOCs being used where vibration is severe—on automotive equipment, compressors, machine tools, household appliances, high-speed looms, aircraft.

FLEXLOCs are available in a wide range of sizes in any quantity. Stocks are carried by leading industrial distributors everywhere. Write for literature and samples for test purposes. STANDARD PRESSED STEEL CO., Jenkintown 1, Pa.

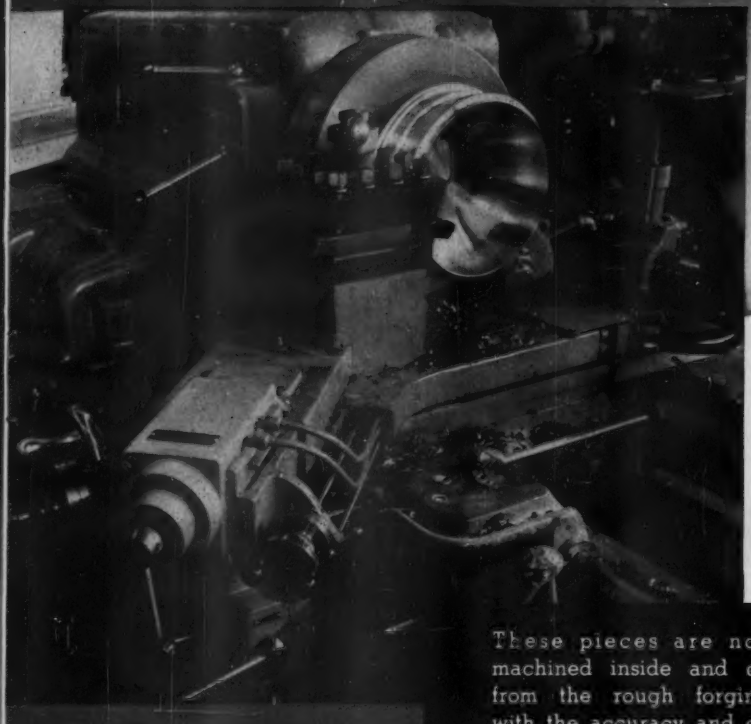
FLEXLOC® LOCKNUT DIVISION

SPS
JENKINTOWN PENNSYLVANIA

Rheem

solves a "toughie"

and increases production *three hundred per cent*



Machining the various contours of these guided missile components with the accuracy and finish required was a problem that Rheem Mfg. Co., Aircraft Division at Downey, California, had to lick.

The answer . . .

"AMERICAN"

HYDRAULIC DUPLICATING LATHES

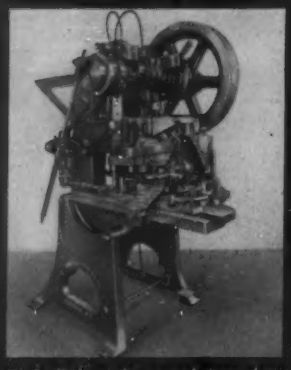
These pieces are now machined inside and out from the rough forging, with the accuracy and degree of finish demanded, in 68 minutes floor to floor —removing 23 pounds of metal from each piece.

The simplicity and dependability of the duplicating equipment plus the power and sturdiness of the "AMERICAN" Lathe proved just the right combination for this difficult job.

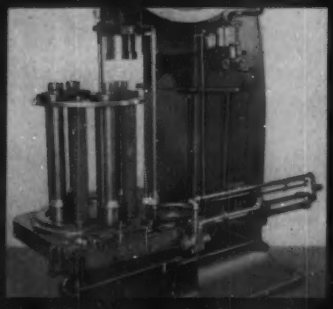
We specialize in "tough ones" —better ask us about your "problem" jobs.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

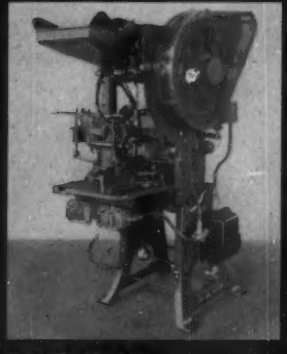
LATHES AND RADIAL DRILLS



V & O has the sturdiness that makes automation practical.



V & O can provide the working height that automation may need.



V & O has the precision that is fundamental to automation.

If made on a standardized assembly line, the mere changing of a few bolt sizes can cause a press to become a "special job." But if made in the V & O shop the most extraordinary of press automation features are just part of the day's work.

V & O was started, 65 years ago, to eliminate the problems of automated press tooling. Our long slide principle, the greatest boon to press automation, was built into the first press we ever made. We have lived with automation, worked with automation, dreamed out the answers to automation problems, for all those years. And there is no such thing as an automated press that does not have special features.

When you have a production problem that can be solved by automated tooling, automated feeds, higher precision tool motions, or tools whose lives depend upon the precision with which the press operates, take it up with V & O.

When you want the press that will be easiest for your own tool makers to automate, be sure that you get a V & O.

Our representative would like to tell you more about the press that is built like a high grade machine tool. Write us, please.

HOW SPECIAL IS A "SPECIAL" MACHINE?

THE V & O PRESS COMPANY

DIVISION OF EMHART MFG. CO.

HUDSON, NEW YORK

BUILDERS OF PRECISION POWER PRESSES AND FEEDS SINCE 1889

65th Anniversary

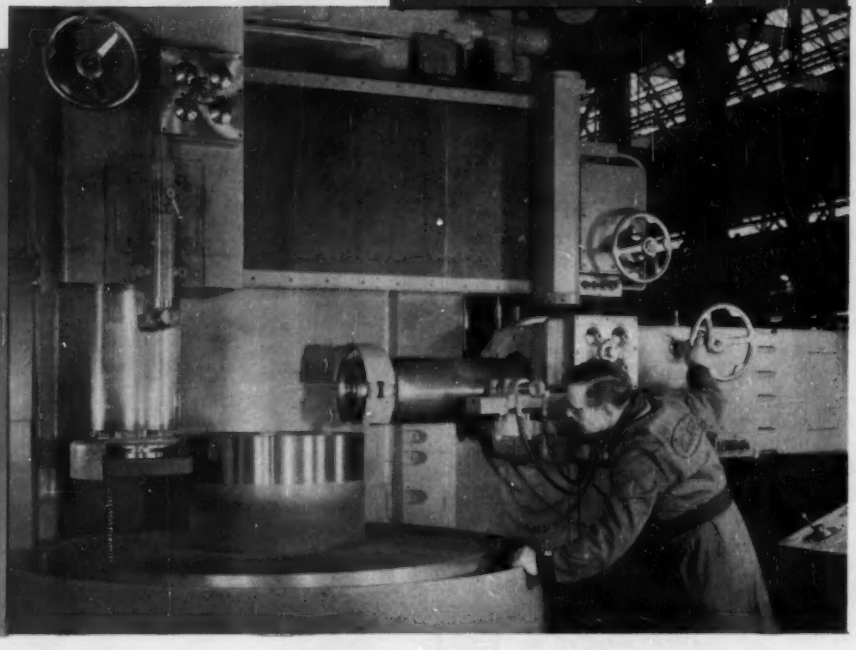
WHY THE V & O LONG SLIDE PROVIDES BETTER ALIGNMENT

With the same running clearance, the longer the slide the less the possibility for angular misalignment. And we keep our running clearances very close indeed.

where *Endurance and Accuracy* count . . .

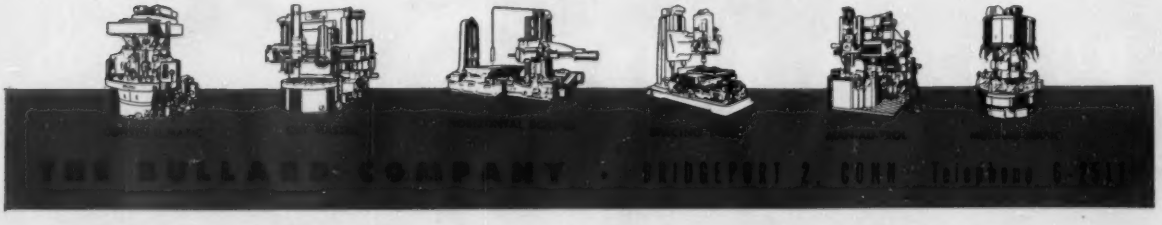
Choose a BULLARD

Have your BULLARD Representative explain the many features of



. . . The Vertical Chucking Grinder

The combined use of mechanical, hydraulic and electrical components provides the accuracy, flexibility, power and ease of operation so essential in precision grinding on larger sizes of work. The Bullard Vertical Chucking Grinder is available in six sizes from 30″ to 74″, made to meet every present day requirement.



THE BULLARD COMPANY · BRIDGEPORT 2, CONN. Telephone 6-7511

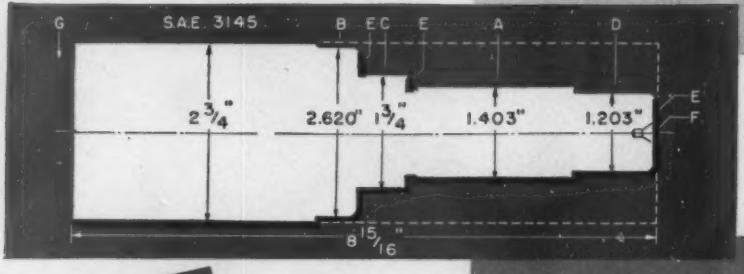
This is the difference High Velocity Turning makes

IN 1950 this job took...

12.40 min.

FLOOR TO FLOOR

A. Turn 489 RPM — .011 feed
B. Turn 340 RPM — .022 feed
C. Turn 489 RPM — .011 feed
D. Turn 489 RPM — .011 feed
E. Face end, shoulders & neck 489 RPM — .0055 feed
Chamfer
F. Center drill
G. Cut off 82 RPM — .0035 feed H.S.S.



IN 1954 this same job takes...

5.40 min.

FLOOR TO FLOOR

A. Turn 694 RPM — .022 feed
B. Turn 694 RPM — .022 feed
C. Turn 694 RPM — .022 feed
D. Turn 694 RPM — .022 feed
E. Face end, shoulders and neck — 694 RPM — .055 feed
Chamfer
F. Center drill
G. Cut off 489 RPM — .0025 feed

J & L TURRET LATHES GIVE...

MORE Ease of Operation
MORE Power Transmission
MORE Rigidity
MORE Accurate Stops
MORE Efficient Lubrication
MORE Coolant on Cutting Tools
MORE Accurate Results

Visitors who attend J & L's periodic "Production Studies" Seminars see this job turned out in just 5.40 min. on a Jones & Lamson #7A Universal Turret Lathe.

Only with lathes like this, built with plenty of power and the beef to back it up, can your shop take full advantage of the quality, productivity and lower costs offered by High Velocity Turning.

This job is one of the many turned at high speeds on our production line. Come to Springfield and see for yourself. At any rate, send for catalogs #101-A and #102.

JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 502 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

J&L MACHINE TOOL DIV.

Another COVEL 80th Anniversary Presentation

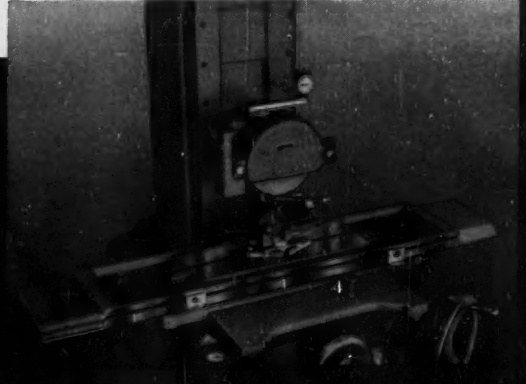
The New COVEL NO. 10

LOW COST POWER AND HAND FEED SURFACE GRINDER

This all-new 6" x 18" Surface Grinder is designed to provide low cost precision gage and form tool work, as well as surface grinding. It will grind work 6" x 18" x 15" under a 7" diameter wheel, has table speed of 10 to 50 feet per minute and longitudinal table travel of 20". Table is driven by special timing belt eliminating rack and gear. Its automatic cross feed is adjustable from .002 to .050 at the end of each table stroke. The grinding wheel head uses any popular make 1 H.P., 3600 RPM direct motor driven spindle. Hand scraped ways, dust proof motor control enclosure, one shot lubrication system, rugged construction with heavily-ribbed semi-steel cast base all go to make the Covel No. 10 outstanding as a tool room surface grinder.

Send for Bulletin AM-94

Set-up for grinding snap gage using indicators and rods.



80 YEARS of continuous manufacturing experience makes your COVEL choice a sound one.

COVEL PRECISION GRINDERS

BENTON HARBOR, MICHIGAN

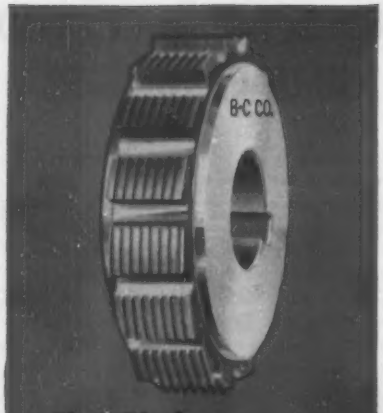
DRILL GRINDERS • UNIVERSAL CUTTER & TOOL GRINDERS • HYDRAULIC & HAND FEED SURFACE GRINDERS

THERE'S A Barber-Colman HOB

Choose from unground, ground, ultra-precision, carbide-tipped, multithread, roughing, pre-finishing or finishing hobs — made with standard or special tooth form, straight or taper bore — in a complete range of sizes and pitches. You'll find one that's designed particularly to produce your special requirements.

Because of more than forty years of gear cutting experience, Barber-Colman engineers can recommend tools which will best fit your requirements. They can supply gear hobs in any of the standard classes of tolerances, plus an ultra-precision class. These hobs range all the way from small 268 DP hobs to those for the largest hobbing machines as coarse as 1 DP. With improved methods and equipment used in their manufacture, these hobs produce gear tolerances exceptional within their respective classes.

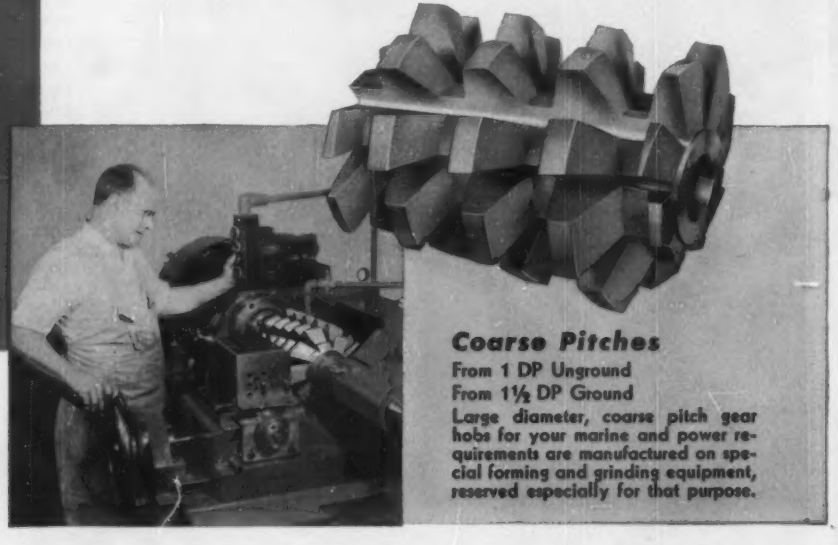
If your plant is cutting gears, you will find this Barber-Colman service the easiest, most direct and efficient approach to control of your gear quality problems. Write today for recommendations on your jobs.



Fine Pitches

To 268 DP Unground
To 200 DP Ground

Barber-Colman fine pitch hobs were introduced for production use in 1936. Today, they are the finest hobs made in the extremely fine pitch class for instrument, fuse, meter and watch gears.



Coarse Pitches

From 1 DP Unground
From 1½ DP Ground

Large diameter, coarse pitch gear hobs for your marine and power requirements are manufactured on special forming and grinding equipment, reserved especially for that purpose.

DESIGNERS OF STANDARD AND SPECIAL

FOR EVERY ONE OF YOUR GEAR REQUIREMENTS

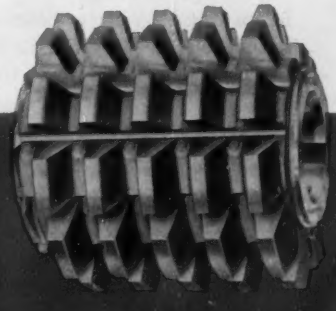
CLASS AA ULTRA-PRECISION HOBS

Barber-Colman engineers are now able to announce another development in gear accuracy. For a number of years we have been making a precision ground hob known as Class AA, to meet the tooth profile tolerances demanded for extreme quietness, smoothness and constant rate of rotation. These hobs are recommended where machine and tooling conditions are consistent with the use of such a fine tool.

Take a close look at your gear requirements and see whether you are taking full advantage of all the refinements available with Barber-Colman gear hobs and gear hobbing machines. Ask one of our field engineers to call and discuss your gear problems, or send blueprints showing the tolerances required. There's a hob in this complete line to take care of your requirements.

Multithreads

Barber-Colman Multithreads are designed especially for high production requirements, and can be furnished with either ground or unground form.



Ground Classes

Class AA Ground
Class A Prucision Ground
Class B Commercial Ground

Unground Classes

Class C Accurate Unground
Class D Commercial Unground

HOBS • CUTTERS • REAMERS
HOBBING MACHINES
HOB SHARPENING MACHINES

BARBER COLMAN

Barber-Colman Company

GENERAL OFFICES AND PLANT, 714 ROCK STREET, ROCKFORD, ILLINOIS, U.S.A.

METAL CUTTING TOOLS SINCE 1908

. . . *but*
Experience Cannot be Copied

More than a quarter-century ago MARVEL invented and basically patented the MARVEL High-Speed-Edge Hack Saw Blade—the UNBREAKABLE blade that increased hack sawing efficiency many-fold.

Every MARVEL Hack Saw Blade ever sold has been of that basic welded high-speed-edge construction, with constant improvements from year to year, as EXPERIENCE augmented the "know-how" . . .

MARVEL is not "tied" to any single source of steel supply, and has always used the best high speed steels that became available from time to time as metallurgy progressed. When-as-and-if finer steels are developed—and are proven commercially practical for welded-edge hack saw blades—MARVEL will use them, regardless of cost or source . . .

There is only one genuine MARVEL High-Speed-Edge! All other "composite" or "welded-edge" hack saw blades are merely flattering attempts to imitate — without the "know-how" of MARVEL EXPERIENCE . . .

Insist upon *genuine* MARVEL High-Speed-Edge when buying hack saw blades—and be SAFE, for you can depend upon MARVEL. They have been "tested", "pre-tested", and "re-tested" by thousands of users for more than a quarter-century!

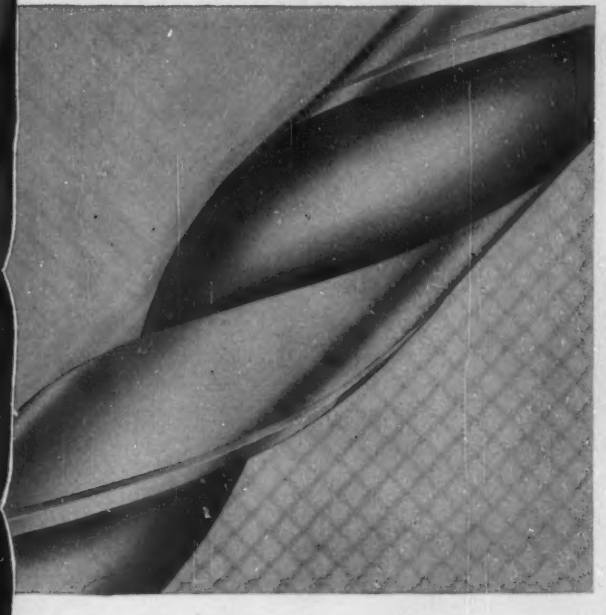
MARVEL *Metal Cutting* SAWS

Better Machines-Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 Bloomingdale Ave. • Chicago 39, U. S. A.

DESIGNED, ENGINEERED

Designed, engineered and produced for maximum performance — Butterfield Drills.



BUTTERFIELD

UNION TWIST DRILL COMPANY
BUTTERFIELD DIVISION
DERBY LINE, VERMONT, U. S. A.

TAPS • DIES • DRILLS • REAMERS • COUNTERBORES • SCREW PLATES

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Call Your
BUTTERFIELD
DISTRIBUTOR

For economy, convenience,

versatility in small-lot production and tool work—

THESE COMPANIES USE THE CLEEREMAN LAYOUT DRILLING MACHINES

Bryant Chucking Grinder Co.	Springfield, Vt.
Package Machinery Co.	Longmeadow, Mass.
New Britain Machine Co.	New Britain, Conn.
Federal Telephone and Radio Corp.	Clifton, N. J.
General Electric Co.	Schenectady, N. Y.
R. C. West Tool and Die Co.	Depew, N. Y.
Daystrom Instrument Div.	Archbald, Pa.
Westinghouse Air Brake Co.	Wilmerding, Pa.
Naval Gun Factory	Washington, D. C.
The Thew Shovel Co.	Elyria, Ohio
The Reliance Electric and Eng. Co.	Ashtabula, Ohio
The Arbor Tool Co.	Dayton, Ohio
The Cincinnati Milling Machine Co.	Cincinnati, Ohio
Allied Products Corp.	Detroit, Michigan
J. F. Mulkey Co.	Detroit, Michigan
Allis-Chalmers Mfg. Co.	La Porte, Ind.
National Automatic Tool Co.	Richmond, Ind.
Le Roi Company	Milwaukee, Wisc.
Hyster Co.	Peoria, Ill.
Fisher Governor Co.	Marshalltown, Ia.
Buick-Olds-Pontiac Div.	Kansas City, Kansas
Chance Vought Aircraft	Dallas, Texas
Products Engineering Co.	Houston, Texas
Continental Can Co.	Seattle, Wash.
Dalmo Victor Co.	San Carlos, Calif.
Douglas Aircraft Co.	Santa Monica, Calif.
Axelson Mfg. Co.	Los Angeles, Calif.

This Cleereman enables F. J. Littel Company, Chicago, to build and alter jigs in their own shop with none of the usual inconvenience. The machine eliminates the need (and cost) of jigs for Littel's small-lot production of roll feeds, straighteners and press accessories.

The Cleereman layout drilling machine has proved its capacity for small lot production and general tool work. If you will survey your own operations (or simply ask us to do it for you), it is more than likely that you will find an area in which it will help you cut costs. For the companies listed above, the Cleereman layout drilling machine has done exactly that!

BRYANT Machinery & Engineering Company
General Office
640 West Washington Blvd., Chicago 6
Representatives in Principal Cities

AFFILIATED WITH

CLEEREMAN MACHINE TOOL CO. Green Bay, Wisconsin

BUILDERS OF PRECISION JIG BORERS AND DRILLING MACHINES

HOW A BIG NAME MANUFACTURER SAVES 80% IN MAN HOURS —PLUS

JOB FACTS:

SIZE—½" diameter, 1½" long

MATERIAL—C-1137 Steel

OPERATIONS—13 including 2 spindle stoppers and pick-off attachment

MACH. TIME—13 seconds

—makes this precision finished steel spindle, completes its 13 different operations in 13 seconds on a 9/16" Acme-Gridley Bar Automatic.

By previous methods the three major screw machine operations required 3 different machines—one for blanking the part, another for milling the spiral oil groove, another for double slotting the end.

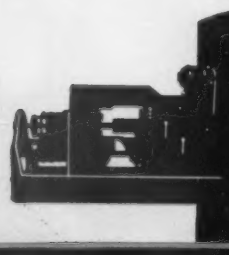
ACME-GRIDLEY 6 SPINDLE BAR AUTOMATIC
Built in 8 different chuck capacities—from 9/16 to 4"

The difference in time for the job—in man hours alone—results in a labor saving of 80%. Value of floor space, cost of extra secondary operation machines, and extra overhead are not figured in.

What "plus" factors? All burrs at oil groove, in slots, on the radiused cut off, are removed on the automatic, by precision shaving the piece all over. The slots are held within .005 of a 90° center line and the collet radius to .0005 concentricity. This single setup eliminates the errors that creep in when it is necessary to rechuck the job, minimizes inspection and scrap loss, insures precise duplication, but adds nothing to the machining time.

At a distance we can demonstrate superior performance only by such examples of completely controlled cycle time and ingenious tooling combinations that apply also to your bar machine work—to save you man hours, reduce your costs or give you a better product. So again we say—

Industry can't do TODAY'S job—with YESTERDAY'S tools ... and make a profit TOMORROW



The NATIONAL ACME COMPANY

170 EAST 131st STREET • CLEVELAND 8, OHIO

ACME-GRIDLEY BAR and CHUCKING AUTOMATICS

1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • Limit, Motor Starter and Control Station Switches • Solenoids • Contract Manufacturing.

UNION

ANNOUNCES

COUNTERBORES

WITH INTERCHANGEABLE PILOTS

Out of significant knowledge gained in making a wide variety of high precision cutting tools comes Union's High Speed Steel Counterbore with Interchangeable Pilots. Available in standard and aircraft designs. Call or write your Union Distributor for full information.

UNION TWIST DRILL COMPANY • ATHOL, MASSACHUSETTS

End Mills Milling Cutters Gear Cutters Twist Drills Hobs Reamers Carbide Tools

OWNERS AND OPERATORS OF: **S. W. CARD MANUFACTURING CO. DIVISION, Mansfield, Mass.**
BUTTERFIELD DIVISION, Derby Line, Vermont and Rock Island, Quebec

YOUR DISTRIBUTOR IS READY TO SERVE YOU PROMPTLY FROM FULL STOCKS

VERSATILITY

..a big word at LANCASTER MALLEABLES

Another on-the-spot photo of a KRW Hydraulic Press in action

only KRW gives you all this!

- **HEAVY CONSTRUCTION THROUGHOUT** — Bed and crown members are truss-reinforced for added stiffness and strength. A KRW exclusive feature.
- **SELECT YOUR PRESSURE** — Required tonnage pressure up to rated capacity can be quickly obtained and locked for repetitive operations.
- **ONE SWINGING BALL ARM** — Controls downward motion of ram, holds pressure on work, or returns ram.
- **ACCURATE "INCHING" OF RAM** — Motor runs only when ball arm is moved for downward ram travel.
- **SPRING RETURN OF RAM** — Gives maximum speed on upstroke.
- **HIGHEST QUALITY** — Radial type Hydraulic pump.
- **DIRECT CONNECTED** — Motor drive through flexible coupling.
- **TWO SPEED HAND PUMP** — Also furnished on motor driven presses in this series.

. . . so they chose the most versatile press they could find!

Lancaster Malleables & Steel Co. makes so many different castings for so many different companies that their choice of a Hydraulic Press for straightening work was a mighty important one. They might have a run of locomotive brake ends, parts for pneumatic tools, automobile jacks, and rear end tractor housings all in one day and they needed a press that could keep pace. We showed them how fast a KRW motor-driven Hydraulic Press converts from one set-up to another — almost before you can say Lancaster Malleables and Steel Co. — and they were sold. Lancaster officials tell us this press is adding to its reputation for speed, accuracy and versatility every day.

WRITE FOR FACTS

You too will save time and cut costs with a KRW Hydraulic Press. Note carefully the features at the left. You get them only from KRW. We make a full line of one, two and three cylinder Hydraulic Presses; 25-150 ton capacities; hand, air or motor driven. Check with your Machinery dealer or write us for full facts and prices.

K·R·WILSON

210 Main Street, Buffalo 3, N. Y.

Designers and Builders of the Right Hydraulic Press to Solve Your Metal-working Problems!

YOU'RE *RIGHT* in the driver's seat

WITH

POTTER & JOHNSTON

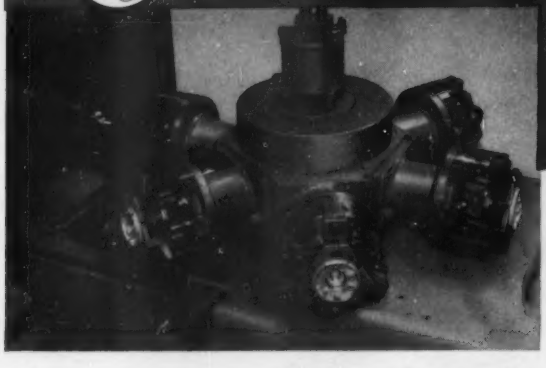
3-U *SPEED-FLEX*

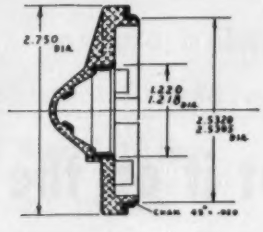
Automatic Turret Lathes

AND

P&J TOOLING

American Bosch manufactures small electric motors used in seat adjuster mechanism for Lincoln-Mercury and other passenger cars. The aluminum housings required are machined at 170 pieces per hour.



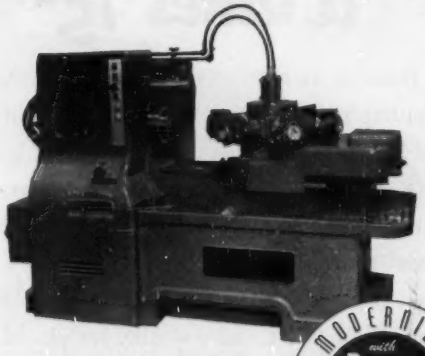


MACHINED SURFACES ARE INDICATED BY HEAVY LINES

Here is an outstanding example of how Potter & Johnston Automatic Turret Lathes, plus P&J Tooling, puts you in the driver's seat—right out in front of competition. The versatility of the 3-U Speed-Flex permitted *mounting the cutting tools in the revolving spindle and chucking the work pieces in the Turret* during machining time.

Machine loading time was eliminated, costs lowered, and production greatly increased by the use of air operated chucks on each of the six turret faces. The operator simply inserts the work piece in the open jaws, a stationary air-cylinder (operated by the dog-drum) automatically controlling chuck opening and ejection, and chuck closing. Turret indexing is automatic, rapid and accurate. Idle cutting time is reduced to a minimum . . . the fast, rapid-traverse mechanism moving the turret slide quickly to within 1/64" of feeding position.

You too can benefit from this combination. At no obligation, send today for your copy of the 3-U Bulletin No. 145 . . . or ask our Tool Engineers to submit recommendations based on your own prints or sample parts.



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POTTER & JOHNSTON CO.

PAWTUCKET, RHODE ISLAND

SUBSIDIARY OF

PRATT & WHITNEY

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Put it on the Blanchard . . .

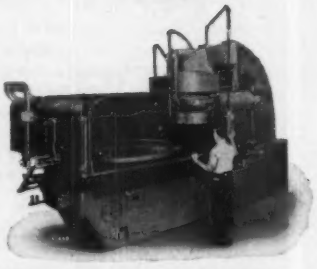
it takes 1/5th the time!

Here is another example of the high production attainable while grinding to extremely close tolerances with Blanchard Surface Grinders and Blanchard Wheels.

It formerly took 45 hours, floor-to-floor, to grind these nine hardened steel machine tool ways. They are 2½" x 3½" x 50" and hardened to Rockwell C-60-63.

Now, these highly desirable results are obtained, using a No. 42-72-84 Blanchard Surface Grinder — nine are placed on the chuck and ground on 6 sides, removing .015" from each surface, parallel to .001", flat within .001" with surface finish of 5 micro-inches. The Blanchard **cut time to 9 hours,** floor-to-floor!

No wonder production men say: "Put it on the Blanchard — it takes less time to do a better job".



This is the largest Blanchard Surface Grinder, No. 42-72-84.

Send for your free copies of "Work Done on the Blanchard", fourth edition, and "Art of Blanchard Surface Grinding".

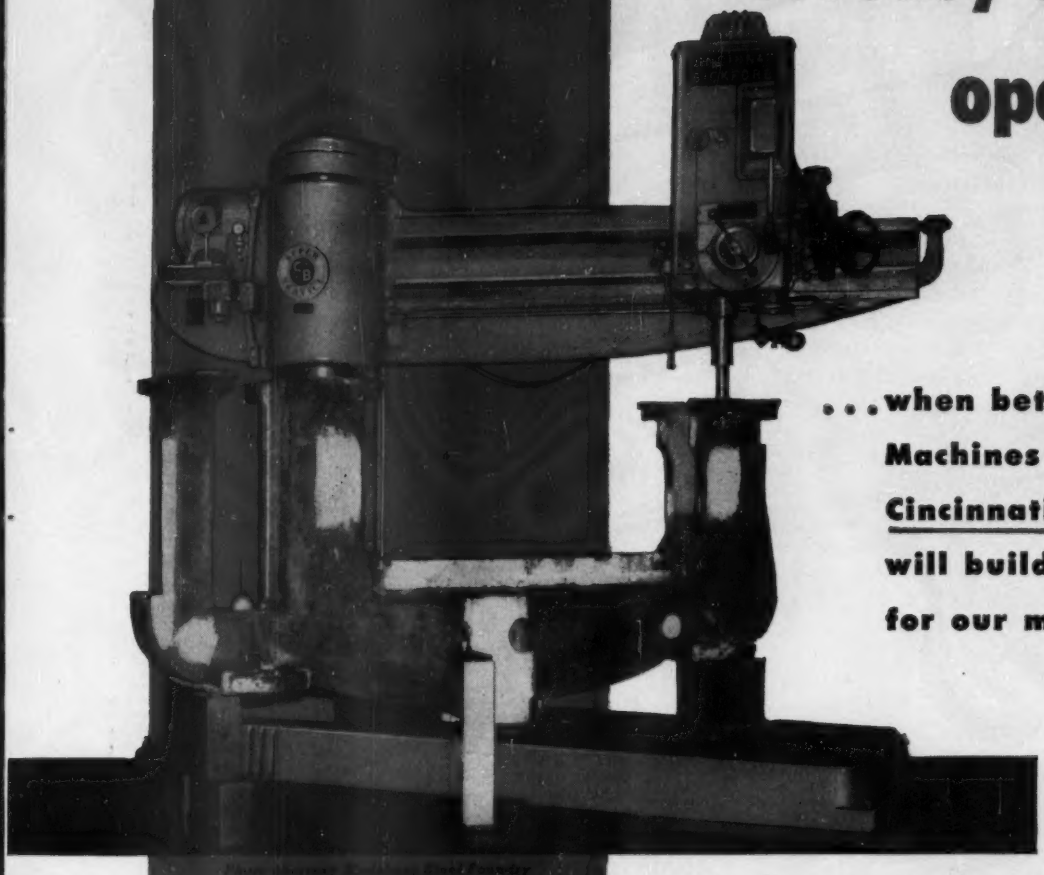
PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

BIRDSBORO STEEL FOUNDRY AND MACHINE CO. says....

"THIS MACHINE IS

well engineered ...easy on the operator



...when better Drilling Machines are built, Cincinnati Bickford will build them for our money"

A 40% cost saving is effected by this Cincinnati Bickford Super Service Radial Drill.

This 10,600 lb. carbon cast steel bottom roll housing for steel plate leveler is being spot faced to a 5" dia. 3/8" deep. Floor to floor time was 25 minutes and now only 15 minutes.

Handling with finger touch ease this Bickford Radial is giving a wonderful performance.

Investigate these fine machines. Write for Catalog R-29.

CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.

ARMSTRONG WRENCHES

Choose Your Wrenches as you do your friends--for life

Specify ARMSTRONG Wrenches for lifetime service, for finely balanced tools that feel right in the hand and make work easier, faster and less fatiguing. ARMSTRONG Wrenches generally are longer for size—give greater leverage. Accurately milled or broached openings give the proper clearance. They are safe wrenches because they are strong beyond need.

Drop forged and machined from high tensile carbon or special alloy tool steels, ARMSTRONG Wrenches are heat treated, tempered and tested to an exact balance of toughness, hardness and tensile strength. Each is beautiful in finish and line, is a quality tool to be proudly possessed by any mechanic—or certain to "give a lift" to any assembly line. Buy wrenches which carry the trade marks HI-TEN or ARMALOY. On carbon or alloy steel wrenches these trade marks are your guarantee of lifetime quality.

WRITE FOR CATALOG

ARMSTRONG BROS. TOOL CO. *"The Tool Holder People"* 5215 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

CINCINNATI 19" HYDROFORM
Five additional Hydroform machines of 8", 12", 23", 26" and 32" capacities are available.

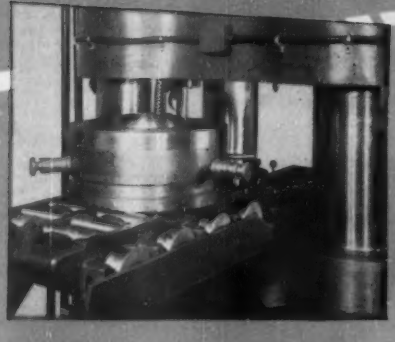
TOOL SET-UP NOW

further simplified

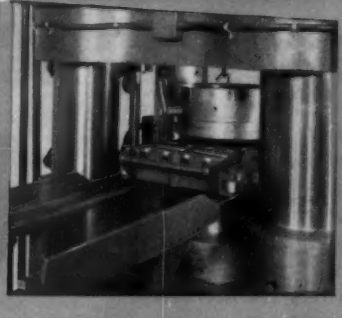
ON THE LARGER CINCINNATI HYDROFORMS

Now supplied with Cincinnati Hydroforms of 19", 23", 26" and 32" capacities is an integral tool conveying and handling system which facilitates the installation and removal of the tooling. The photographs below illustrate the tool handling method which eliminates any manual lifting of the components.

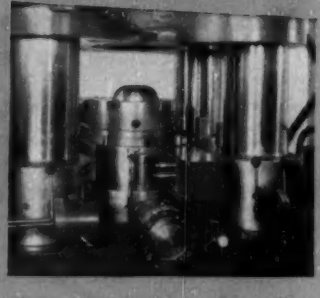
Design refinements such as this continue to simplify Hydroforming—which in itself has reduced the deep drawing process to its simplest form. Investigate the many Hydroforming advantages—for your part development work—or for short run production. Let a Cincinnati Milling field engineer give you complete details. For general Hydroform data and specifications of the six machine sizes, write for your copy of Bulletin M-1759-3.



a Roller conveyor for moving Hydroform tools—punch, draw ring and draw ring support—into position. Punch is seated on pins inserted through holes in draw ring support. Three lifting rods are inserted into draw ring support.



b Roller conveyor with tooling beneath the Hydroform dome. By lowering dome, connecting "S" hooks and then raising dome, tooling is lifted. (In this view, punch has been removed to show two of the "S" hooks holding tooling.)

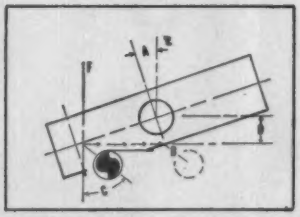


c Tooling in final position. Lowering dome seats tools on bolster plate. Lifting rods are removed. Connecting punch to the ram completes the set-up. Tools are self-centering. In this manner, tools can be changed in 10 minutes.

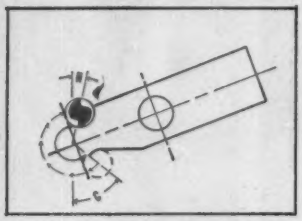
CINCINNATI Hydroform

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.

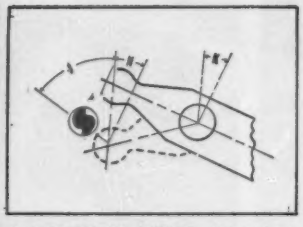
This part is finish milled direct from the blueprint, with a single setup, in 17 min.!



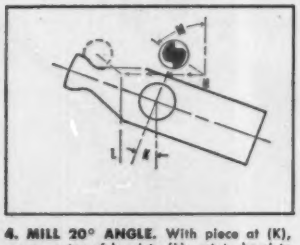
1. MILL 20° ANGLE. Index piece to angle (A), offset spindle slide to radius (B), set rotary head to angle (C), saddle to (D). Feed table (E) to (F).



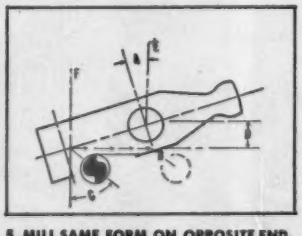
2. MILL .642/.645 DIAMETER. Rotate head angle (C) to angle (H).



3. MILL 1⅝ IN. RADIUS. Rotate head fromangle (H) to angle (J), index dividing head from angle (A) (Oper. 1) to angle (K).



4. MILL 20° ANGLE. With piece at (K), move center of head to (L); rotate head to (M). Feed table (L) to (N).



5. MILL SAME FORM ON OPPOSITE END. Repeat operations 1 through 4 by indexing the workpiece to angle (A-Oper. 1).

Kearney & Trecker Model 2D Rotary Head Milling Machine saves six hours on 50 piece run

HERE is another example of the tremendous time and tooling savings possible with the rotary head milling method.

This manufacturer used to complete a control lever every 24 minutes. Now the same work is completed in only 17 minutes... and no multiple setups or expensive form cutters are necessary. The blueprint is the only guide the operator needs — the machine's precise mechanical control of the cutter's angular and radial movements does the rest.

THIS IS THE MACHINE that will handle your light production milling faster, easier and at tremendous savings over any other method. If you have any production problems in plastic molds, die-casting, forging and stamping dies, or selected production milling operations — investigate the Model 2D.

Here's the Rotary Head Milling Machine Production Idea Booklet. It contains several examples of how this method has been found exceptionally efficient in solving production, die, forging and metal pattern milling problems. It's yours for the asking.

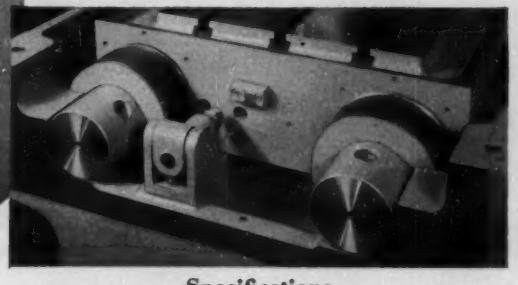
Address requests to Kearney & Trecker Corp., 6784 W. National Avenue • Milwaukee 14, Wisconsin

KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS

THE BRYANT 6" STROKE *all Mechanical* BORING MACHINE

provides...

uniform accurate production



Specifications

Total table stroke	6"
Top of table to top of bridge	4"
Width of bridge	27⅜"
Multiple boring heads as required by tooling to a maximum of (4) 209 heads	
Table dimensions	17½" x 22"
Floor space (without coolant tank)	31" x 54"

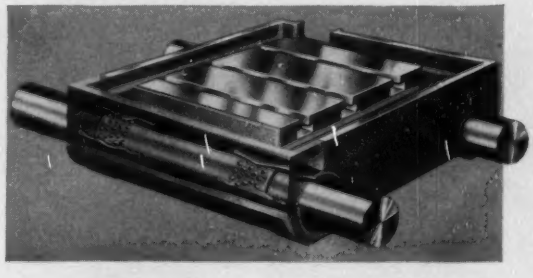
The Bryant 998 Boring Machine is a production machine for precision boring, drilling, turning, facing, grooving and contour turning and boring where fine finish and rapid production are desired.

Constant repetitive accuracy is designed into the Bryant 998. The table is mechanically actuated by a simple cam and lever unit. The cycle is positive . . . free from variation due to temperature change.

The table moves on two 4" dia. hardened and ground solid steel bars firmly bolted to the bed. Each slide bar has two widely separated bearings — hardened steel sleeves surrounding retainers in which 150 balls of ⅜" diameter are mounted under preload.

This rugged slide construction provides metal-to-metal contact, resists loads from any direction, provides sensitive response and uniform travel.

The Bryant 998 will withstand heavy use and will continue to produce parts within tolerance at the specified production rate.



Mail coupon for complete details!

BRYANT CHUCKING GRINDER CO.
SPRINGFIELD, VT.

Gentlemen: Please send me your Bulletin 998. AM

Name.....

Title.....

Company.....

Street.....

City.....Zone....State.....

BRYANT Chucking Grinder Co.
SPRINGFIELD, VERMONT, U. S. A.

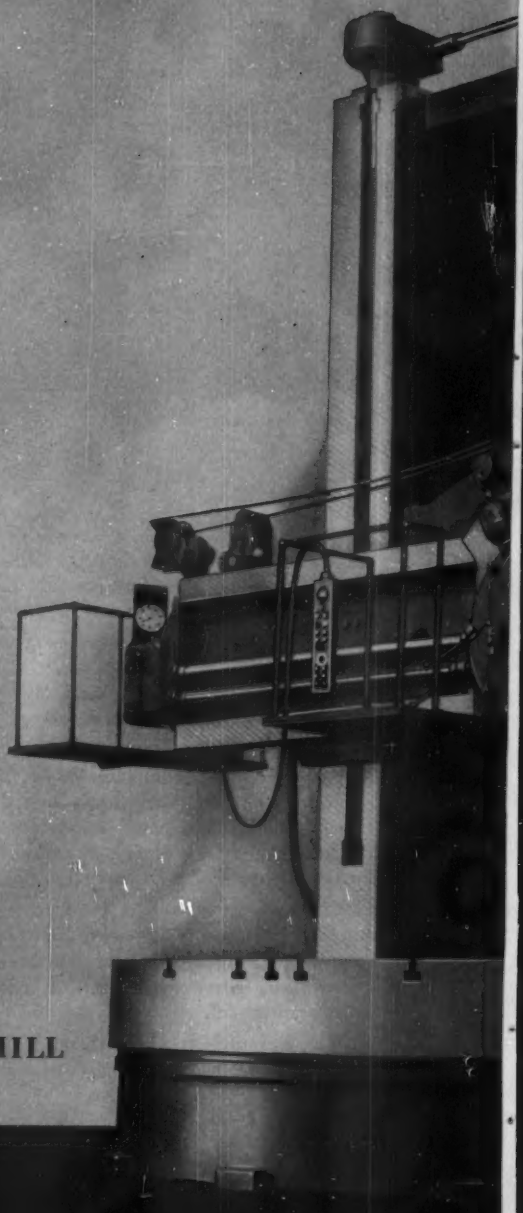
Internal Grinders • Boring Machines
Internal & External Thread Gages • Granite Surface Plates

...another BIG one!

Yes, it's a big one, but Consolidated builds them larger and also smaller.

But more than bigness is the quality of the engineering thinking that goes into Consolidated Machine Tools. For example, on this 20 Foot BETTS Vertical Boring Mill, there isn't a single gear shift lever on the entire machine! Gear changing and all other operating functions are performed 100% from the pendant switches at the cutting tools.

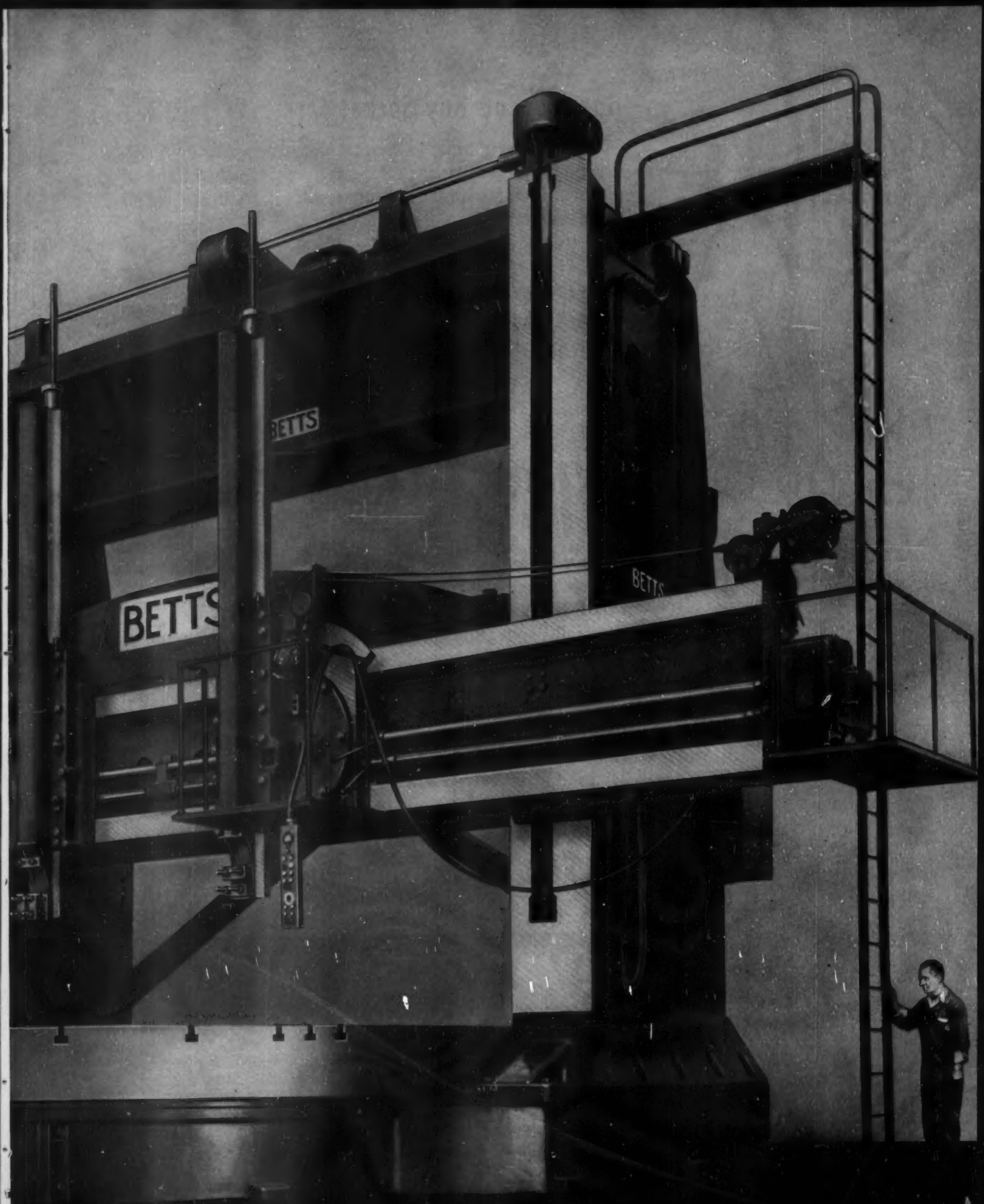
In Consolidated Machine Tools you get tomorrow's engineering today!



BETTS 20-FOOT
VERTICAL BORING MILL

CONSOLIDATED MACHINE TOOL

Wholly owned subsidiary of Farrel-



CORPORATION, ROCHESTER, N. Y.

Birmingham Company, Incorporated

How Do You Buy Socket Screws?

Many buyers continue to specify some one make by *habit*. They have no particular preference for it, but they think of *all* such fasteners simply as "screws with hex sockets" — *all* makes substantially *alike*.

If you buy that way, and have never tried P-K Socket Screws, just break the habit once, and give them an actual assembly test. You'll get a pleasant surprise.

You'll find that the hex shape of the socket is about the *only* way that other makes and P-K are "alike".

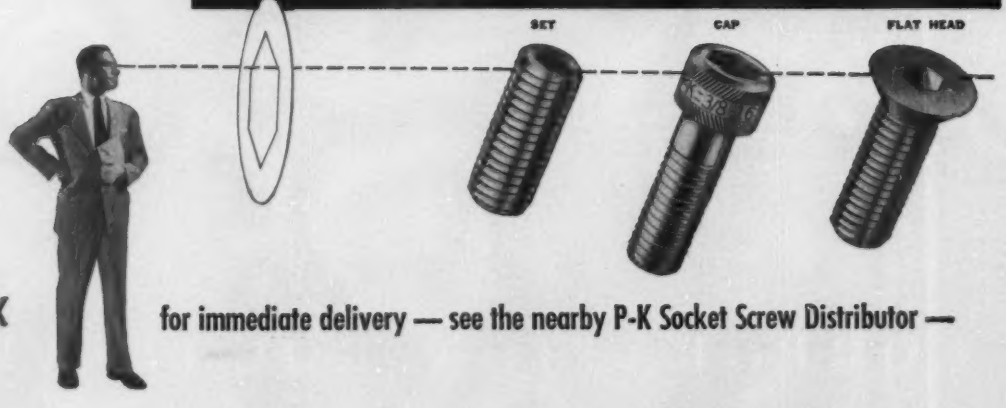
Look Beyond the Hex

It pays to *look beyond the socket* when you buy Socket Screws. Compare every detail of product and service. You'll find P-K Socket Screws take top rating in every test. You get exclusive features that simplify and speed up assembly. You get quality matched to a firm guarantee. You get planning and buying information exactly patterned to your needs.

You need *all* these essentials for cost-wise assembly. Why miss out on *any* of them? Just try P-K Socket Screws. Get samples from your P-K Distributor, or write: Parker-Kalon Division, General American Transportation Corporation, 200 Varick St., New York 14.

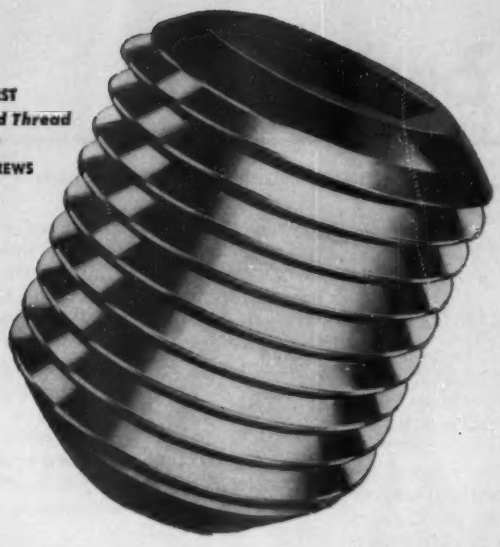
for all the essentials of cost-wise assembly

PARKER-KALON®



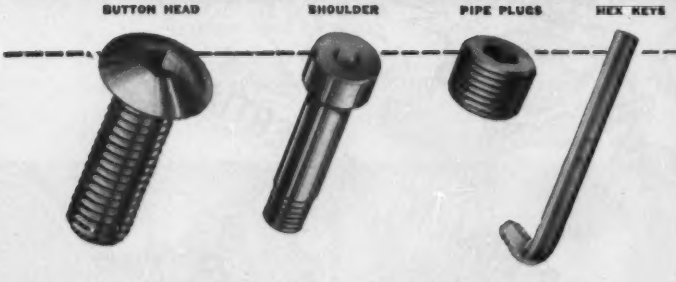
IN STOCK for immediate delivery — see the nearby P-K Socket Screw Distributor —

THE FIRST
Ground Thread
SOCKET
SET SCREWS



THE ONLY
Size-Marked
SOCKET
CAP SCREWS

SOCKET SCREWS



your local Supply and Service Specialist

In Socket Set Screws PARKER-KALON gives you

- **GROUND THREADS** — at no extra cost. Gage-like precision, mirror-smooth finish — uniform, dependable Class 3 tolerance. Mechanics like their easy starting, easy keying.
- **PROVED ASSEMBLY STRENGTH** The "proving ground" is the millions of assemblies made by thousands of satisfied users of P-K Socket Screws, whose products are used everywhere, many under the toughest conditions of vibration.

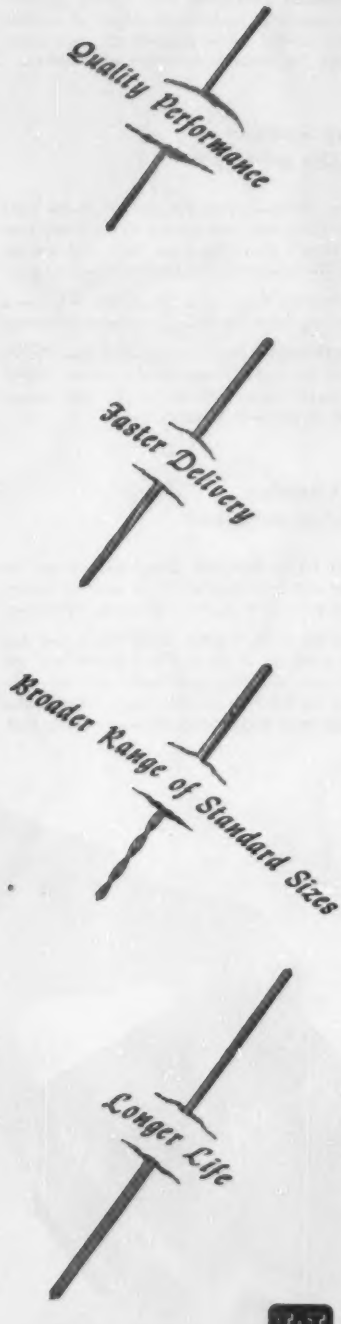
In Socket Cap Screws PARKER-KALON gives you

- **SIZE-MARK** — offered only by P-K. Incised on the head of each screw, it saves time and wasted screws when sizes get mixed up, prevents errors by green help. Maintenance and service men like Size-mark, it helps in reassembling.
- **GEAR GRIP** Meshing firmly with finger tips, it prevents slipping and fumbling when hands are oily, speeds starting.
- **MAXIMUM STRENGTH** Head, socket, and threads are accurately formed by Parker-Kalon's cold-pressure process. Steel structure "flows" to conform to all contours, assures maximum strength at points of greatest stress.

In all Socket Screws PARKER-KALON gives you

- **GUARANTEED FIRST QUALITY** Based on tests and inspections at every step in production — an exacting routine of quality control supervised by P-K laboratory Technicians.
- **FULL RANGE OF STYLES AND SIZES** You'll find any Socket Screw you need, NC or NF, in P-K's complete line, and Hex Keys in all sizes, and in several handy sets. Ask your P-K Distributor for the P-K Price List, Catalog, — any information you need. Slide chart Socket Screw Dimension Finder Free.

L&I Reamers give you more



L&I
The Reamer Specialists
LAVALLEE & IDE, INC.
CHICOPEE, MASS.

Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

Tool Drawings OK

Jack Finlay's idea for keeping tool drawings up to date (*AM*—Mar 15 '54, p100) sounds reasonable, but I think the system we have is better. After a tool drawing has been approved and sent to the toolroom, no changes can be made without written authority. Corrections or changes may be marked on the print in yellow pencil, but a written record must be made in duplicate. One copy is attached to the print, the other is sent to the tool design dept. And both copies must be signed by the toolroom foreman.

The tool inspector works to the original print, and if he finds any changes for which there is no corresponding written form, he rejects the tool until such time as the toolroom foreman supplies one.

Tool-drawing change forms are checked daily by the chief tool designer, and those involving merely correction of errors or other small changes are passed to a junior draftsman who makes the alterations on the original drawing immediately. If major changes are involved, they go to the designer who made the original drawing. Theoretically, it might be possible for the designer to disapprove the change, but actually the toolroom foreman is either sure of his ground before he authorizes the change, or he has checked verbally with the designer before signing the form.

As soon as a tool has passed inspection, the original print, together with all its change forms, is returned to tool design, and company rules require that a recheck and all corrections be made immediately. Then drawings are Microfilmed and stored in the vault.

John K Westerley
Detroit

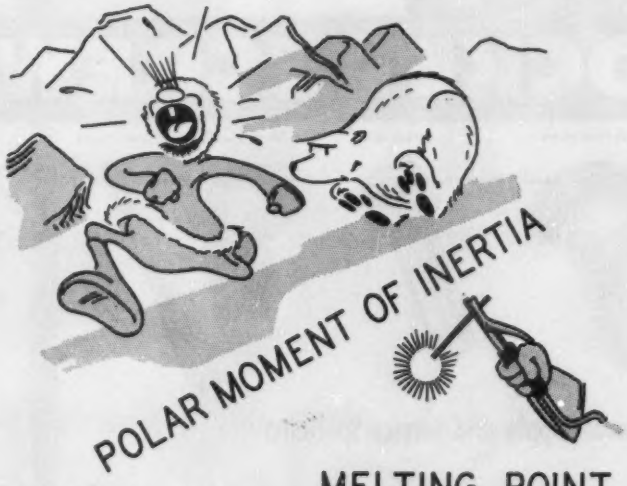
Too Good To Be True

It probably is a good thing that people—engineers, too—have a sense of humor. There are times when a good laugh does a lot for a person, particularly when fortune has been a little rough with him.

I did not get around to reading "Miracles by Appointment" (*AM*—Jan 18 '54, p273) until after I and a score of other engineers had received notice that we were to be laid off. I had started looking for a new job, and one advertisement was very enticing because it offered $30,000 a year. With certain slight changes, many of the requirements set up by prospective employers read almost identically with your "Mira-

GRINETICS

By D G SMITH



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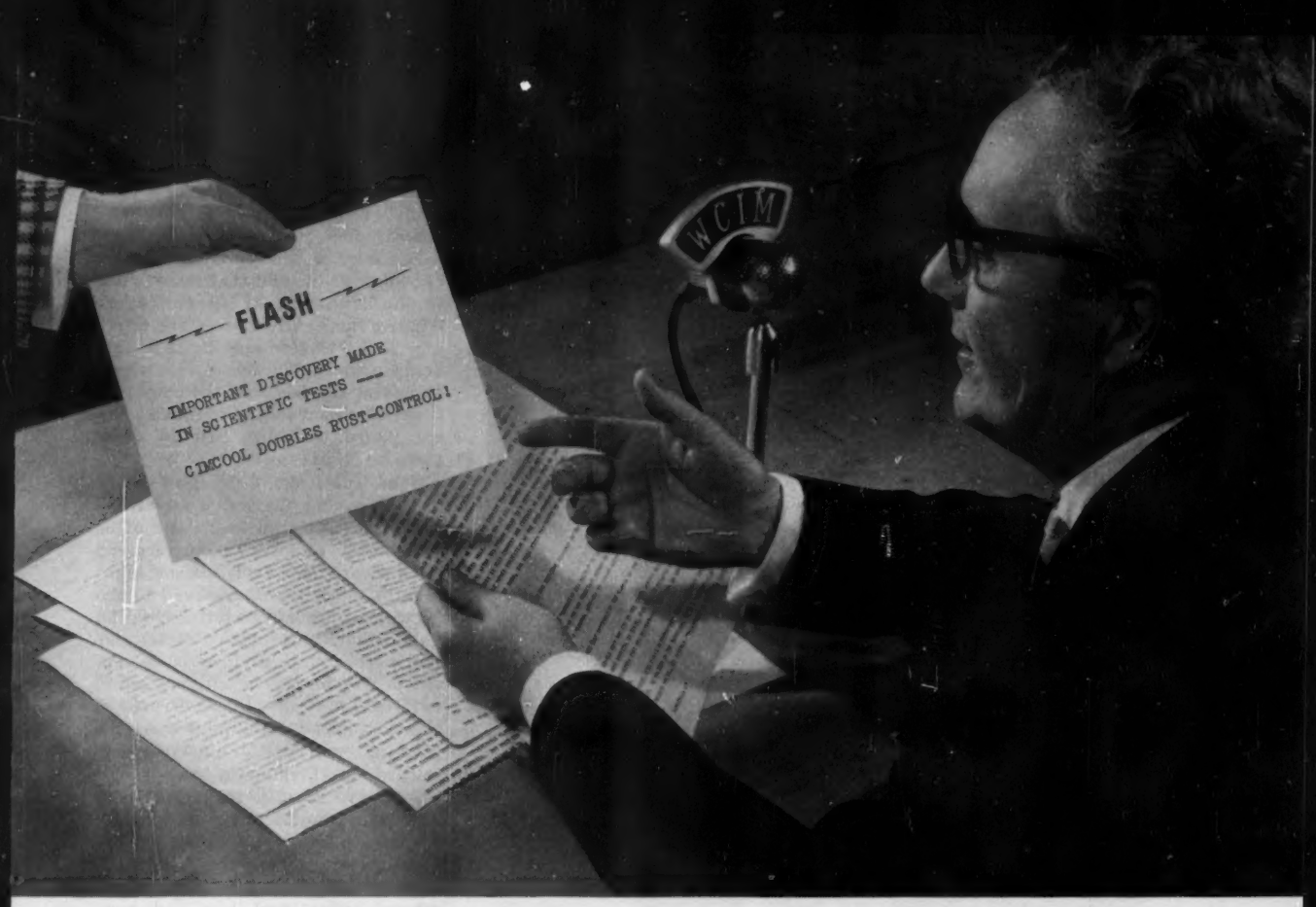


Tests Prove That CIMCOOL With "95-16" Doubles Rust-Control

The good news is being flashed coast-to-coast. Actual scientific laboratory and shop tests prove that adding "95–16" to CIMCOOL° *doubles rust-control* as compared with a formula without this amazing ingredient.

And while doubling rust-control, this radically new and different coolant—this *chemical emulsion*—saves you money many other important ways. Plant after plant reports that CIMCOOL covers 85% of all metal cutting jobs . . . and does a better job. It permits faster speeds because it combines friction reduction and cooling capacity in a degree never before attained by old-fashioned coolants. It's longer lasting in machines. So CIMCOOL reduces downtime and cuts labor costs for cleaning and changing.

We invite you to prove to yourself what scientific tests and on-the-job experience have already proved. Put CIMCOOL to the test in your own plant—on your own machines. For a demonstration write, wire or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.

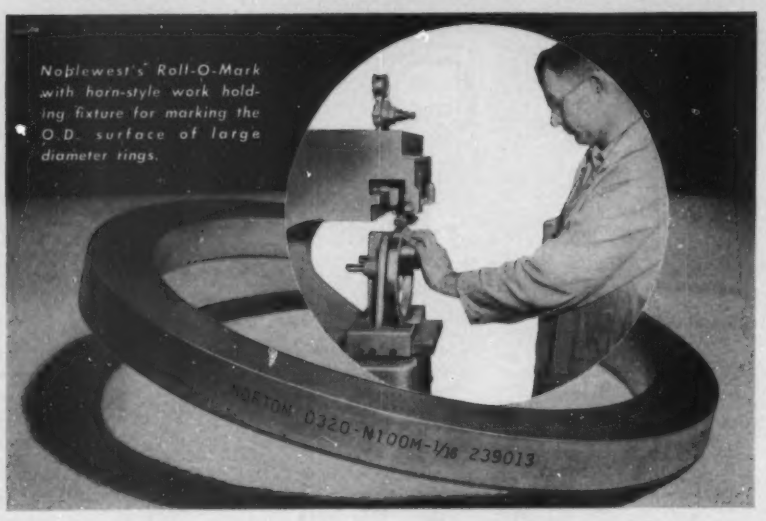
CIMCOOL

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

LEADERS IN INDUSTRY MARK WITH NOBLEWEST

NEW HEAVY DUTY **ROLL-O-MARK**

MULTI-PURPOSE METAL MARKING MACHINE



Noblewest's Roll-O-Mark with horn-style work holding fixture for marking the O.D. surface of large diameter rings.

FEATURES

- ***Extra large work capacity***
- ***Greater versatility***
- ***Marks, numbers, graduates, embosses***
- ***Low operating cost***

Marking the surface of large diameter rings is just one of the many applications that are being done faster, better and at lower cost in many industries today with the new heavy duty all-pneumatic Roll-O-Mark. This one machine can be tooled for marking round or flat surfaces . . . precision graduating . . . serial numbering . . . knurling . . . and embossing.

Whatever your needs for metal marking, Noblewest makes the machines, marking dies, and work-holding fixtures for doing the complete job. And remember, Noblewest Roll-Marking is *permanent* marking—*good for the life of your product.* There is a Noblewest representative near you. Write Noble & Westbrook Manufacturing Company, 17 Westbrook Street, East Hartford 8, Conn.

All-pneumatic, Model 365 is the heavy duty version of the famous Model 50PI.

Be sure to visit Noblewest Booth 520 at The Tool Engineers' Show.

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MARK IT BEST WITH

NOBLEWEST IMPROVED MARKING DEVICES

NOBLEWEST

ORIGINATORS OF THE ROLL MARKING PROCESS

cles." I could not truthfully send a reply like the one you mention, but I believe I have the ability to handle many of the high-paying jobs supposedly open just now.

But here is a situation that I do not approve of, and that must work to the detriment of all employers seeking help: Advertisers are offering high wages—specific amounts being named—but actual interviews bring out the fact that the employer never intended to pay so much. The big figure was just bait to draw high-grade prospects.

Some years ago, a group of us answered a very attractive advertisement but, although every one of us was highly qualified, none received an answer. However, six or eight months later, we all received in the same mail a honeyed letter from an employement agency of which we had never heard, inviting us to register. Maybe it is circumstantial evidence, but we will never believe the original advertisement was genuine, nor will we lose our suspicion toward "good" offers in ads.

I believe most conscientious people know whether they are qualified for a specific job and would not apply for anything beyond their capabilities. I have applications in for several exceptional jobs, but none pays $30,000. I am certain that, in certain industries, I could save enough to make an employer delighted to hand out such a sum, but this knowledge has not brought me any actual offer. And I am still suspicious of the ad that looks too good.

Name Withheld

Trash or Treasure

I think Bert Hall (*AM*—Mar 15 '54, p156) may have the right idea when he says that pilfering is bad for all concerned, but he has overlooked an important point concerning employee good will. Lots of times men want a few inches of barstock, or a bit of sheet metal, or maybe a few nuts and bolts, and there's just no place to buy it. Sometimes you can get bolts at a hardware store (although they cost about five times their real value), but where can you

get, say 4 in. of ⅝-in CRS? Often a guy will have a little project he is working on at home, and that bit of stock is all he needs to finish it. Sure, if he picks up a bar end and slips it in his pocket, he is stealing, but you can't blame him when he knows that it will be thrown out as scrap anyhow. Of course, you've got to draw a line against the guy who takes stuff home every night, lets it pile up, and then sells it to a junkie, and also the guy who looks on a 6-ft "bar end" as legitimate scrap.

Now maybe this wouldn't work in a big plant with thousands of employees, but in a small shop it's easy enough to give the watchman a scale, and let him weigh the stuff and charge so much a ponnd for what the boys bring out. Sure, you may lose a few cents when somebody gets a bit of stainless for the same price as cold rolled, but it won't amount to more than a dollar or two in the year and you more than get that back in good will. You can set a limit to check the greedy, then if a man wants something over this, let him go to the purchasing department and buy it at the price you paid. That will put an end to stealing and the men will really appreciate it.

Leonard A West
Indianapolis

Why Not?

I guess the Japs have got the right idea (*AM*—Mar 15 '54, p105). Let them keep on building ships for Russia so the Russians can keep all their own yards busy building submarines. But when Russia decides to liberate Japan from the evils of American capitalism, I hope they won't expect us to save them.

I know we have to help our former enemies, as well as friends, get on their feet again, but if they insist on doing business with the Russkies, why don't we say, "OK, but for every ruble you get from Russia, we'll knock off a corresponding amount of dollars from the dough we figured to send you"? We could save a good-sized wad that way, and they would be no worse off.

John Sabold
Providence

MAINTAIN HIGH SPEED and EXTREME ACCURACY with OLIVER ACE
Universal Tool and Cutter Grinders

For decades the OLIVER ACE has been an important factor in maintaining toolroom schedules. It grinds the most difficult cutters quickly and accurately—really excels on high speed and Tungsten-Carbide work. The OLIVER ACE is simple to set up and easy to operate. Soundly engineered, the ACE is designed and built to give dependable accuracy . . . proved through daily use.

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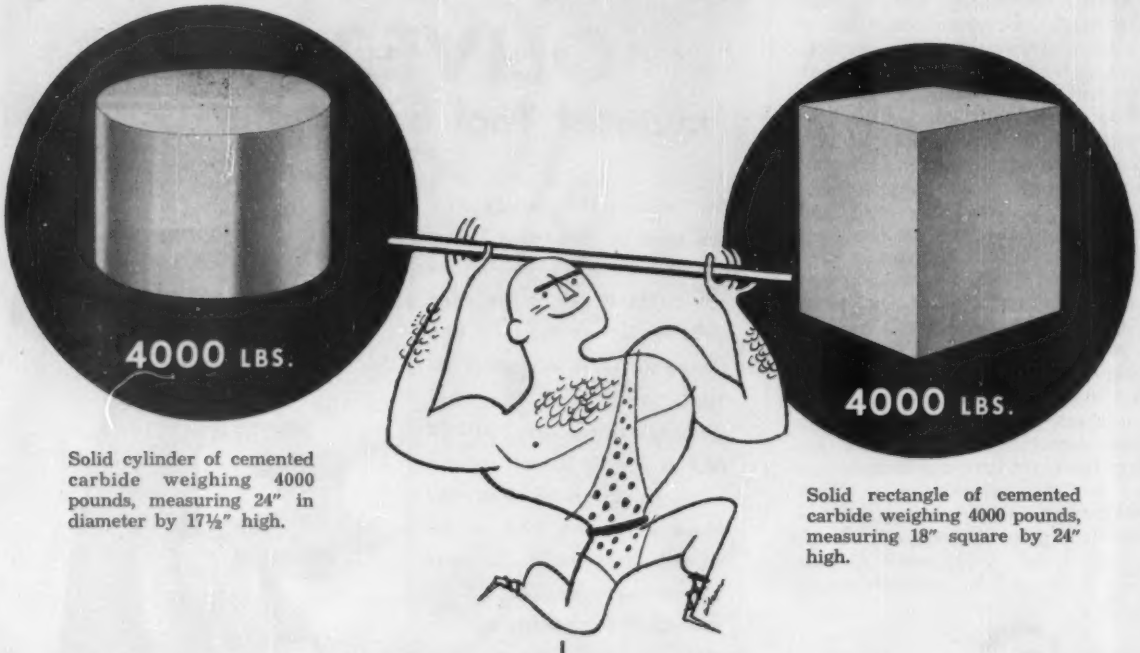
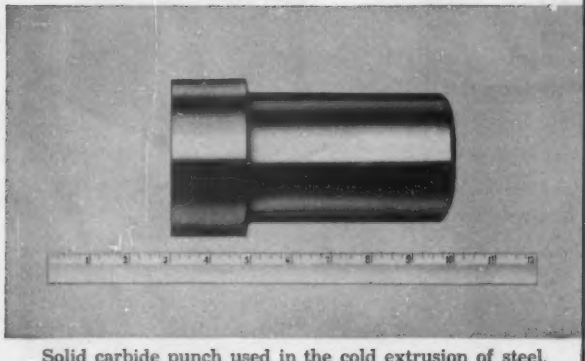
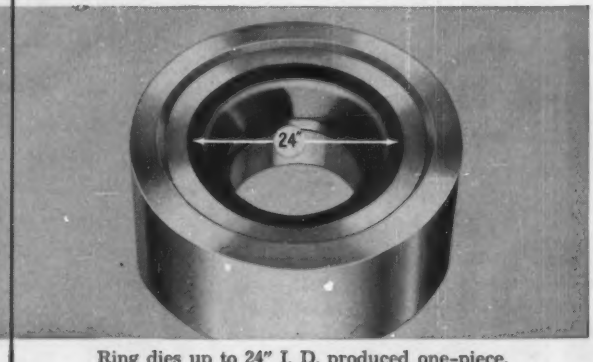


Solid cylinder of cemented carbide weighing 4000 pounds, measuring 24" in diameter by 17½" high.

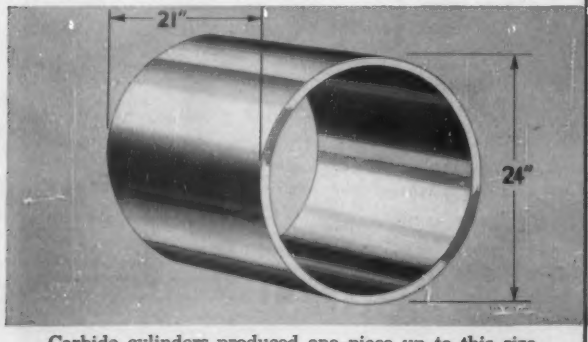
Solid rectangle of cemented carbide weighing 4000 pounds, measuring 18" square by 24" high.



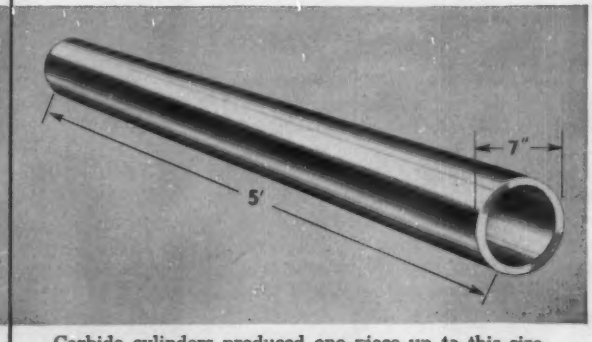
Solid carbide punch used in the cold extrusion of steel.



Ring dies up to 24" I. D. produced one-piece.



Carbide cylinders produced one-piece up to this size.



Carbide cylinders produced one-piece up to this size.

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New 220-ton hot press now in operation. Makes carbide pieces in either solid or hollow shapes—in heights up to 5 feet with maximum diameter of 7 inches. Or, in diameters up to 24 inches with maximum height of 21 inches. Up to 4000 pounds in weight. Processing time cut 50% by this method.

Among the many types and shapes the new press can produce are parts for large die sections, rolls for rolling steel strip, punches for cold extrusion work, large linings for brick molds and other parts where the costly factor of wear must be reduced.

Engineers surveying the field. This pressing technique for cemented carbides is so new, applications for it are constantly being developed. Carboloy engineers are helping manufacturers and die makers determine where and how large cemented carbide parts can reduce costs and increase production.

Survey your own plant. Why not survey your own plant for large part applications where wear is a problem. Carboloy engineers can give you specialized assistance. For additional information, please send coupon or write.

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Gentlemen:
I would like to determine if large pieces of cemented carbide would reduce costs in the following applications:

_____

_____

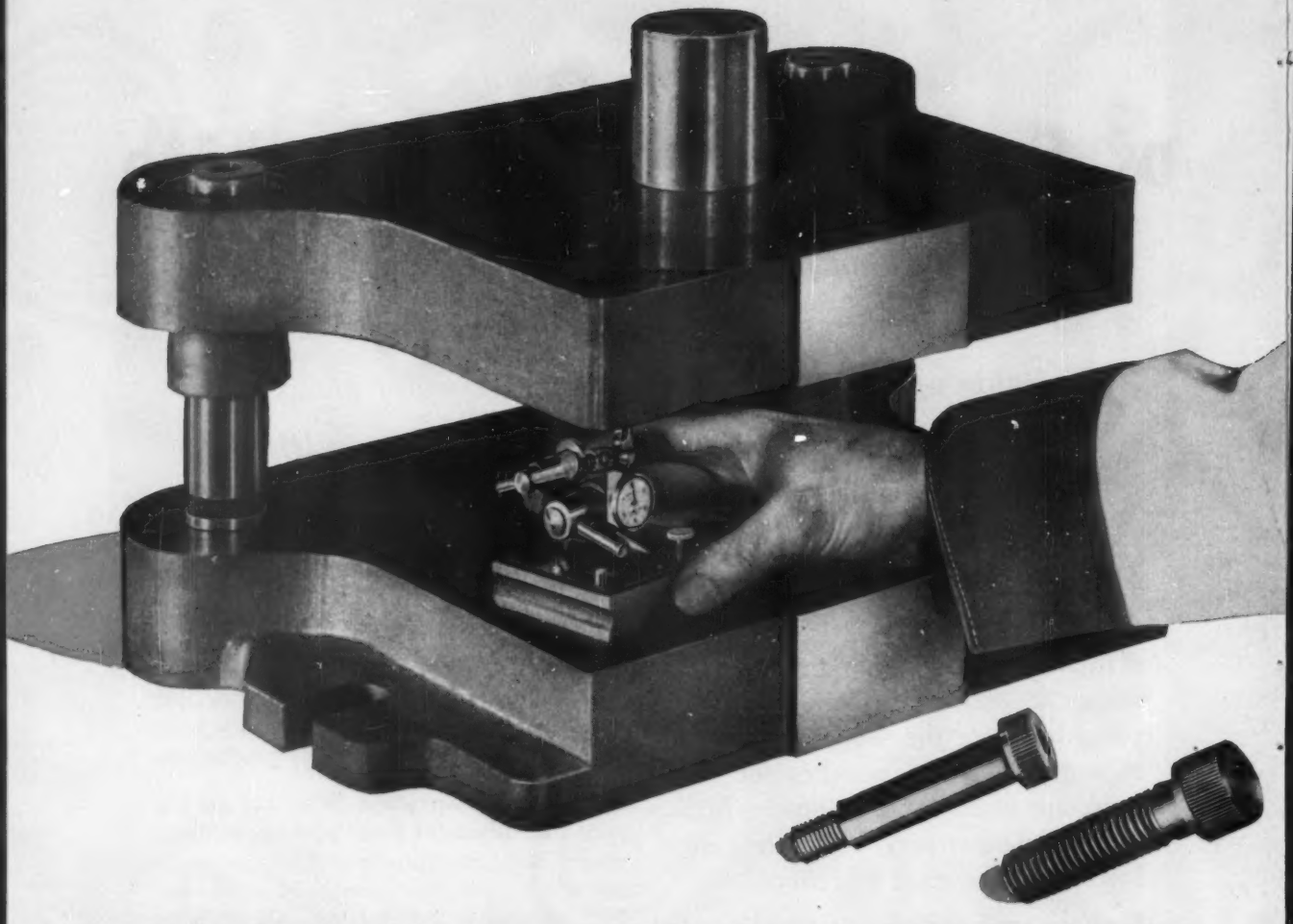
Please have a Carboloy engineer ☐ call at plant. ☐ call for appointment.

Name _____ Title _____

Company _____

Address _____ Zone _____

City _____ State _____



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Spot News of Metalworking . . .

- **Compressor blades for jet engines are being rolled** by an adaption of the Krause rolling process. Stock held in tension by gripper dies is rolled between 3-in.-dia contour rolls backed up and driven by contour plates that control thickness. One in. of stock is rolled to a 5-in. blade needing only edge finish.

- **Perfect pure iron crystals 100 times stronger** than those of any known metal have been developed by General Electric Co research. Crystals are rust resistant, too. To date, G-E doesn't know any use for them, but expects to find some applications shortly.

- **Plant dispersal is meaningless in the Hell-Bomb age.** The US must depend upon the natural dispersal that is the basis of the subcontracting system — plus plenty of up-to-date equipment capable of coping with design changes resulting from battle experience.

- **Millions of dollars worth of new equipment** will be bought by aircraft manufacturers with their own funds when and if accelerated tax depreciation goes through. These firms now operate equipment 60-70% owned by the government but bought under WWII pressure, designed years before that, and not of the right type, capacity, or accuracy to meet modern aircraft needs.

- **Czechoslovakia claims it far outstripped machine tool output** schedules laid down for 1953 by its Russian rulers. Exceeding quotas were turret lathes, automatic and semi-automatic lathes, cutters.

- **Go-ahead signal for a $37.5-million aircraft order** authorized last year under the US Offshore Procurement Program is being sought in Washington by high officials of Italy's Fiat company.

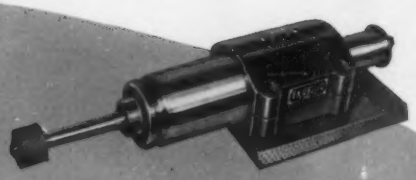
- **Die steels that withstand 80,000 psi at 1000-1150 F,** that can support tongues with a length-width ratio of 10 to 1, are the goal of Firth-Sterling, Inc's research program to develop new die alloys. First step: setting up extrusion-die steel requirements.

- **Spar cap mill with a bed 308 ft long** is being installed by a West Coast plant. Separate heads will perform successive operations on several spar caps clamped along the bed.

- **Routine and control analyses of titanium and titanium alloys** for carbon, common and rare metals are offered by a research firm.

- **Hughes Aircraft Co will build a $1½-2 million assembly plant** and checkout facility at its Tucson, Ariz, guided missile plant.

Grinding small holes with an Ex-Cell-O 25,000 RPM High Frequency Motorized Spindle



Single-body, belt-driven internal grinding spindle.

Double-body, belt-driven internal grinding spindle.

25 hp heavy duty precision spindle with 24" grinding wheel.

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Get the most from your precision grinding operations by using the Ex-Cell-O Spindle that's made especially for the job.

Ex-Cell-O Precision Spindles have long been the original equipment choice of leading grinder manufacturers. They are rigid and smooth-running. For high precision work they are fitted with standard Ex-Cell-O Precision Ball Bearings; for slower speeds and heavier cuts they are equipped with heavy-duty Ex-Cell-O Precision Ball Bearings. They require no lubrication or adjustment. Phone your Ex-Cell-O representative or write to Ex-Cell-O in Detroit today for catalog 25962 listing hundreds of standard grinding spindles.

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33-32

Washington . . .

Defense Department contractors are worried about the Pentagon's virtually complete stoppage of new orders for planes, ships, guns, and other munitions. They say that the failure of procurement officials to place new orders means that actual production of needed weapons and components is bound to drop drastically.

Here's the picture: last fiscal year (which ended June 30, 1953) the military placed some $18.7-billion in orders for major procurement items. But in the nine months since then, the Pentagon has placed orders at a rate that would mean only $1.5-billion in new orders for the whole fiscal year ending June 30, 1954.

• • •

On the face of it, this seems to clearly indicate a sharp drop-off in arms deliveries about a year or 18-months from now—that is, the normal lead-time on such items. And this is what hard-goods producers are saying. But the top military brass deny this.

Military officials say that the hold-up on placing new orders will end soon and that it was necessary as part of the "New Look" review of our whole military program. Furthermore, they offer two reasons why this won't cause a big slump in arms deliveries in the future. Shorter lead times are now being demanded and this means deliveries won't show the same drop, ever, that contract placements have shown. And they say there has been enough inventory in the military pipelines to take up any slack that might otherwise show in deliveries.

In other words, contract-signing will pick up in plenty of time to assure a continued flow of production and delivery of needed items on schedule. It's hard to figure who's right on this — it may get an airing in Congress.

• • •

Furor over H-bomb is bringing no noticeable changes — or increase in emphasis — on Civil Defense and protection of plants against such attacks. No one questions the Soviet's ability to place such bombs in or on many of our major cities — which are the backbone of our arms production.

Government officials admit that dispersal — of both people and defense plants — is the only real answer to such a threat. But Washington can only offer advice — plans — on what you should do about this.

Pentagon officials agree that current procurement policies are no aid to dispersal of war plants. Budget-cutting brought about a cut-back in the original "Broaden the Base" procurement program. And budget-cutting also means placing orders with the lowest-cost bidder, no matter where he is located.

• • •

Tax amortization can be given to companies that are expanding — an extra percentage may be allowed for going to a dispersed site. But amortization isn't withheld from a company that is otherwise eligible, even if it is building right at "ground zero" of a critical target area.

Tax amortization is also being given — 100% write-off in five years—for construction aimed at sheltering production equipment and employees. But so far only a couple of companies — notably Cincinnati Milling Machine — have actually applied and gotten it.

• • •

Industry's own trend toward the suburbs is the good sign in the whole picture. It's been going on for years, and will really help a lot if atomic war holds off long enough. Tax amortization officials say about 80% of expansion aided by certificates is in dispersed sites — this is, 10 miles beyond the boundaries of the critical target area as drawn up for some 92 cities by office of defense mobilization.

• • •

The Defense Dept has set up a task force to inspect military-owned machine tools now stored in warehouses. Plan is to arrange for removal and disposal of tools "somewhat obsolete and not entirely standard." These tools would be formally declared surplus and sold at public auction.

• • •

The Justice Dept has called SBA's Production Pool Program — in which small firms combine facilities to secure military contracts — a failure. In a report to the President, evaluating the program, Justice blamed reluctance of military procurement officers to deal with the pools as reason for the failure. Only 10 pools have obtained military work since Korea.

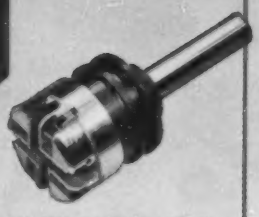
• • •

President Eisenhower wants a new Taft-Hartley Law badly to fulfill a campaign pledge. But he doesn't want it badly enough to take the version proposed by the House Labor Committee — which he considers to be much too tough on unions.

That's the reason for the delay in committee action. The administration is fighting to prevent the members from voting out the bill they want, trying instead to get them to tone it down. Some members are being hardheaded and may refuse to come up with any amendments. There is a good chance, as a result, of no new bill at all this session.

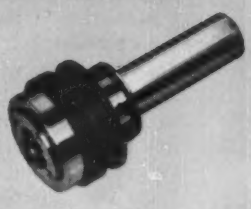
Reduce THREAD COSTS and *Increase* THREAD QUALITY with MURCHEY TOOLS

Precision-Pak with die heads and collapsible taps automatically taps holes up to 4" dia., cuts external threads up to 3½" dia.—also bores and reams. Lead accuracy assured by precision lead screw.



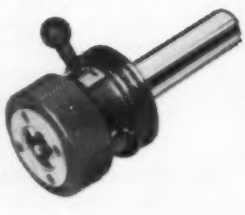
Rotating Die Heads, Type "ORB" with snap action trip and quick change radial type chasers, cut straight threads ⅛" to 5" dia.

Non-rotating Die Heads, Type "OLB" with pull off snap trip and quick change radial type chasers, cut straight threads ⅛" to 5" dia.

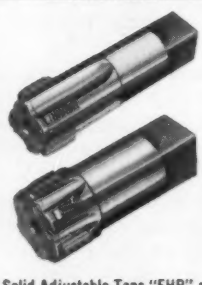


Rotating Die Heads, Type "TRB" with snap action trip and quick change Tangent chasers, cut straight threads ⅛" to 2" dia.

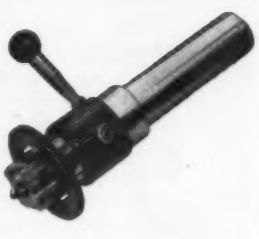
Non-rotating Tangent Die Heads, Type "TLC", with pull-off snap trip and quick change chasers, cut straight threads ¾" to 2" dia.



New 4 in 1 Type "ACB" Die Heads, Rotating and Non-Rotating feather action trip, cut straight threads ⅛" to 4" and tapered pipe threads ⅛" to 3½".



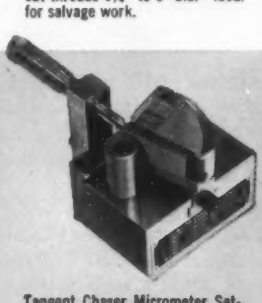
Solid Adjustable Taps "EHB" and "RHB" with removable chasers, cut threads 1¼" to 5" dia.—ideal for salvage work.



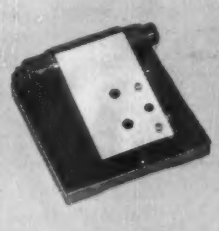
Standard Collapsible Machine Taps, Rotating or Non-Rotating, with easy size adjustment, cut straight threads 1¼" to 7" dia.

Semi-receding Pipe Taps, Rotating or Non-Rotating, with taper receding action, cut 1" to 6" taper pipe threads. May be arranged for straight threads also.

Type "L" Machine Taps, Rotating or Non-Rotating, with 18 interchangeable nose pieces and 2 bodies, cut a range of straight threads to 6¼" dia.



Tangent Chaser Micrometer Setting Fixture provides longer chaser life and better threads through more accuracy in setting chasers in their holding blocks.



Universal Chaser Grinding Fixture for use on either a surface or cutter grinder assures accuracy in grinding chasers of all types.

For more complete information on Sheffield-Murchey threading tools, get in touch with your local representative or write for Catalog MU-153.

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MASTER CRAFTSMAN SHEFFIELD HEADQUARTERS

SHEFFIELD

6548

Detroit . . .

Production juggling this month among makers of luxury cars included:

Cadillac's anticipated decision to resort to overtime to meet demand. By going to a 10-hour day (from 8), production will increase by about 140 cars daily.

Going into 1954, the division had 93,000 orders on hand, had scheduled 1954 output of 117,000 units, a mark it has definitely been missing. It built only 6400 cars in February.

Lincoln-Mercury's cancellation of second shift at Metuchen and St Louis. L-M's action meant layoffs for 3100 workers and represented the first important Ford cutback since last summer.

Packard's backtracking, productionwise. At new-model time, President James Nance said the company planned to build and sell 100,000 cars this year. Company officers now, however, are hedging, saying that the program is built around an "annual 100,000-car output," spread over several years.

Nance feels a margin of 10% of the public wants autos styled distinctively away from the big three lines (although some big three members patterned after Packard this year). That 10%, Nance feels, belongs to the independents (who accounted for less than 5% of first-quarter production).

Packard's basic idea is to stay in its present price range, leaving it as the only manufacturer which is exclusively in the top price bracket. Being the only luxury car-maker among independents, the company could fit quite neatly into any future merger—that line of thinking being responsible for the continual rumors linking Packard with other independents in merger speculation.

• • •

Lincoln-Mercury's new Forward Product Planning Dept may be another step toward separation of the two divisions.

The department is separate and distinct from both the Lincoln and Mercury Product Planning Departments, may be scheduled to perform a coordinating function between the two, should they be divorced. L-M announces only that the new department is presently just a one-man operation.

• • •

Big question about Henney Motor's offer to buy Reo Motors for $16.5-million: what would Russell Feldmann, Henney president, do with Reo if the sale goes through this summer?

His main interest now is Henney, which only last December paid $5,170,000 for Eureka Williams Corp. Henney builds specialized vehicles: ambulances, hearses, etc, (it recently experimented with a 30-passenger station wagon).

Reo's position is clearer. First, its president, Joseph Sherer, has specialized during his career in making sick companies well, then moving out. Feldmann suggests, though, that he would retain present Reo management. Reo was not sick when Sherer joined it in 1943, but it probably will need vitamin shots when its military truck contract is broken off.

Of the approximately 15,000 trucks Reo built last year, about 75% were for the military. Profitwise, its high point was 1947 when it netted nearly $5 million. The next year, it barely broke even and in 1949, lost about $2 million. Thereafter, it profited $2-3 million annually.

Guesses: Henney may try to brighten Reo's truck picture, groom it for later sale to a truckless independent (American Motors, perhaps); expand custom body operations, maybe even enter the expensive, limited production car field to capitalize on interest stirred by the Corvette, Thunderbird, Kaiser-Darin, etc.

• • •

With only 13 makes of cars entered, and at least seven assured of winning, the Mobilgas Economy Run had a little something for almost everyone.

In the interests of space-saving, it seems appropriate this year to list only the losers: Chevrolet, Ford, Plymouth, Mercury, DeSoto, Nash, Packard and Chrysler. All other name-plates entered had a winner or two.

One cinch bet was included in the line-up. Hudson's Jet-Liner was the only entry in the low-price category using automatic drive. It would have been a winner even if it had pulled in with a one-mile-per-gallon record.

• • •

When Ford Div found it had sold more cars and trucks than any other maker during the six months ending in February, it was pleased to report that it beat the "second rated" make by 9126 cars and 2345 trucks.

"Second rated" is a term Chevrolet officials introduced last December when calling attention to Chevvy's leadership over the full year.

Ford beat all its own first-quarter sales records of the last 30 years, delivering over 3,777,000 units — a rather formidable figure, since it was established in a winter "recession" period.

• • •

Nash's Metropolitan seems worth its production cost in promotion value alone. During the 10-day period in March when the little car was introduced, Nash's over-all sales jumped 64%.

With tooling costs reported by Nash to be something under $2 million, the showroom traffic stimulated by the little cars might as well be chalked off to advertising as to tooling.

5346

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WITH PORTELVATOR®

THE HANDY HAMILTON PORTABLE ELEVATING TABLE

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IT'S A
Hamilton Tool
USE IT WITH CONFIDENCE

Machine Tools . . .

An agreement upon what machine tools can be put on a list of non-strategic goods for shipment to Soviet Russia and her satellite countries is now being negotiated in London between a team representing the US State Department and a British team.

Ralph Cross, director of the Metalworking Equipment Division of the Business and Defense Services Administration, Department of Commerce, is in London as technical advisor to the US team.

• • •

The British precipitated the negotiations by seeking Russian orders. A delegation of British business men, including Robert Asquith, former president of the British Machine Tool Trades Association, came back from Moscow recently with a considerable volume of orders. Mr Asquith is reported to have brought back for his own company machine tool orders of around $18 million.

The agreement now being negotiated will give US blessing to the shipment of certain types and sizes of machine tools to Russia by the British.

• • •

It is a fair assumption that US builders will be granted the same privilege as the British to ship machines behind the Iron Curtain.

Non-strategic US machine tools should be on any approved list for shipment to Russia and to other eastern European countries, in the opinion of one of the chief US government departments in Washington.

US builders, in other words, should be granted the same trading privileges as the British, the argument runs.

• • •

Even if US builders are allowed to ship machines behind the Iron Curtain, there is no guarantee that they will get any of the Russian business.

The Germans and French will be given the same right of shipment to East Europe as the British and Americans.

Some observers feel that the Germans and British will run away with the Soviet machine tool orders. The Russians will place the orders in the countries in which they stand to gain the most politically. The United States would be excluded on that basis.

• • •

British attitude toward selling machine tools to Russia seems to be about like this:

The Russians are producing machines in considerable volume. Machines coming from England would merely add to the numbers in Russia and would not provide the Russians with any equipment they could not build themselves because of any technical limitations.

British machine tool men who visited Russia are said to have been much impressed with the job the Russians are doing in manufacturing machine tools.

• • •

Russian copies of VDF (German) lathes were coming off a production line at the rate of three per hour, one lathe maker reported. He checked the accuracy of these machines and found that they were at least as good as current Western practice.

• • •

N. M. Andrienko, leader of the USSR trade delegation in the United Kingdom, was one of the honored guests at the annual dinner of the British Machine Tool Trades Association recently.

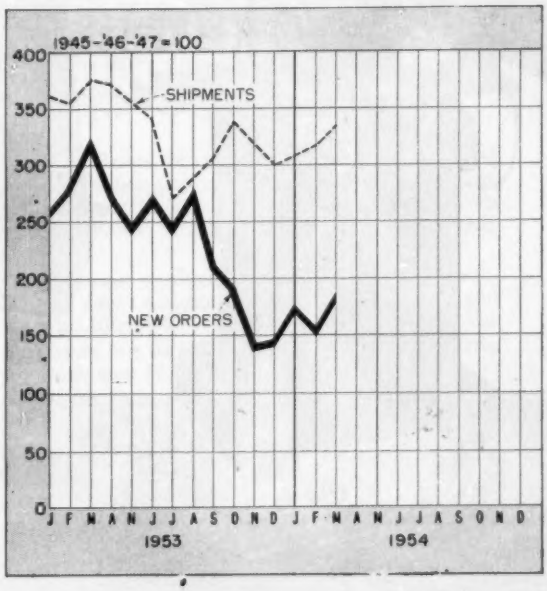
"It was perhaps not altogether by chance," one report states, "that members and their guests enjoyed a soup whose recipe was of Russian origin."

BF

MACHINE TOOL INDEX

(1945-47 = 100)

Source: National Machine Tool Builders' Assn.)



March New Orders rose some 30 points to 182.1 on the index, or $54 million. Shipments, too, showed a healthy jump over February to 336.3 index, or $100 million. Figures are "estimated preliminary" because of incomplete returns.

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T-P MACHINE TOOLS
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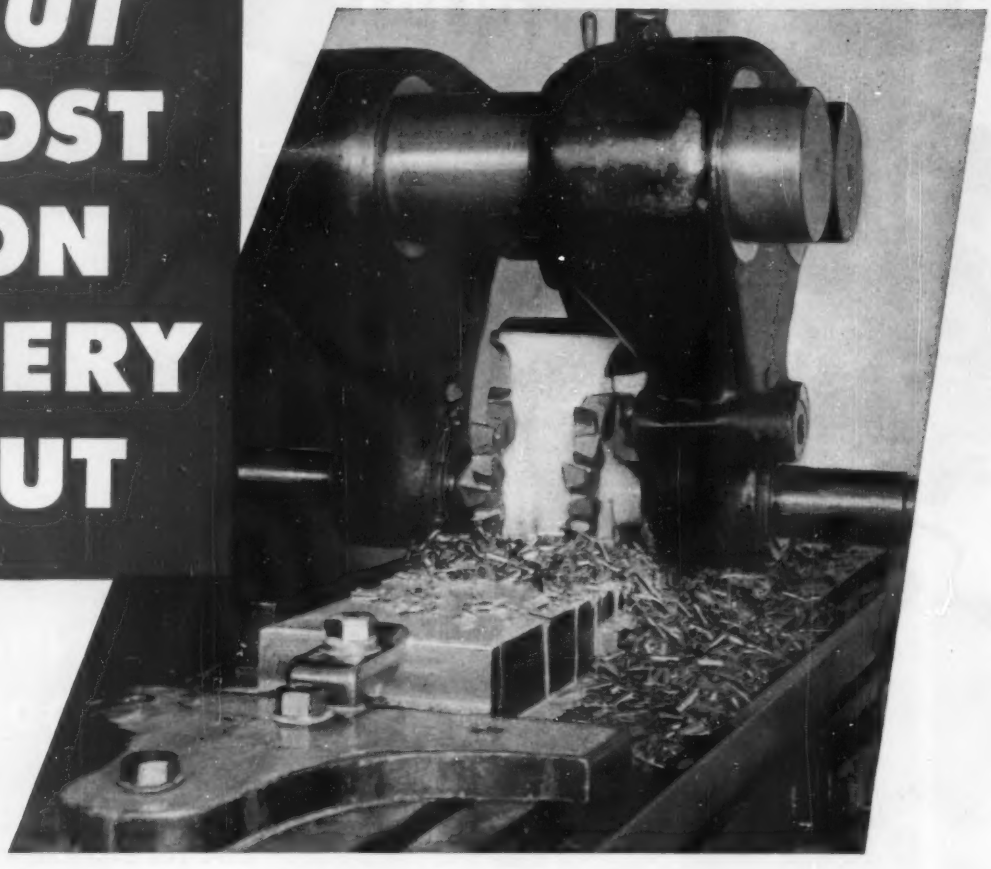

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Gaging Metalworking . . .

PRODUCTION INDEX

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	APR '54(*)	MAR '54(p)	FEB '54(r)	MAR '53
Tot. Index	**143**	**148**	**152**	**168**
Machinery	127	130	147	
Electrical Machinery	162	164	195	
Autos	116	114	135	
Other Transportation	273	290	286	
Other Metalworking	125	128	140	

(*) Estimated (p) preliminary r) revised

Things are beginning to look up in Metalworking. The plus factors are more numerous than the minus.

Capital spending for new plant and equipment, for one thing, will be above the 1953 mark, a McGraw-Hill Economics Department survey reveals.

The increase dollarwise over last year will be 10%. Even more new capacity will be built this year than in '53.

Machine tool orders rose some 30 points on the index of the National Machine Tool Builders' Association in March. Some builders report April sales have been better than those in March.

Farm implement and tractor people are feeling pretty good. Reason: Farm income this year won't be down much from last year.

A large number of manufacturers believe that their business will pick up before midyear, according to a survey by the National Industrial Conference Board. Four of ten companies expect this quarter's production to exceed that in the first quarter.

• • •

Industrial supply and machinery outlook is brightening considerably after a long decline dating back to March 1953.

For the second consecutive month, American Supply & Machinery Manufacturers' Association's new order index shows a slight upturn.

February index figure is at 140.5, against January's 139.8 and December's 136.7. Index is based on July 1948 = 100, showing that February orders are 40% above par.

This means a turnabout in the declining Federal Reserve Industrial Production Index, if the ASMA's new orders index continues to be a metalworking bellwether.

• • •

Metalworking will buy 36% more steel in May than it did in February, according to a survey of 240 steel-buying metalworking companies undertaken by Solar Steel Corp of Cleveland and covering about 85% of US metalworking capacity.

Here are some of the survey results: 37% report higher steel inventories than a year ago, 29% have reduced them, and 34% report no significant change.

But the majority of steel users surveyed say that they will cut their inventories back to normal within 40 days, then resume normal buying.

• • •

Appliance outlook for this year is good. Manufacturers' consensus is that 1954 appliance sales for all lines will run only slightly below 1953's $5 billion figure.

Radio and TV accounted for half of last year's $5 billion sales, promise to come fairly close to that this year.

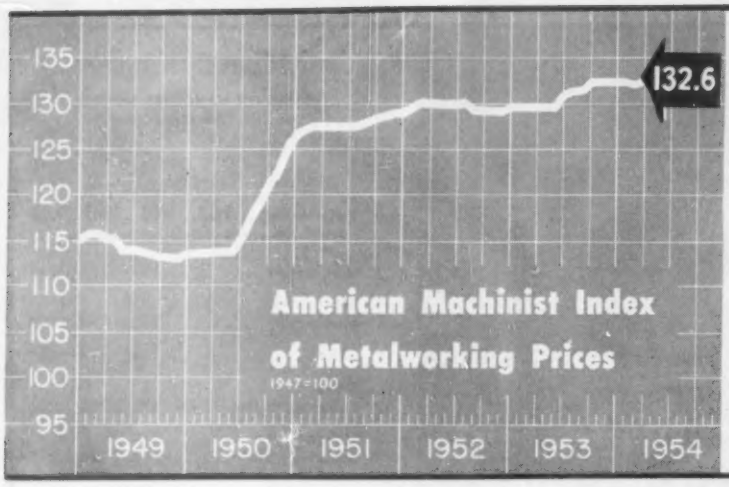
Radio is doing astonishingly well: 1954 sales are expected to equal the 15 million sets sold in 1953.

The TV picture isn't quite as good, but it's far from dark. Last year's sales of 7.2 million sets was close to an all-time record.

In general, the TV industry expects a 5-10% decline. But individual companies expect to capture a bigger share of the '54 market.

Other appliance lines are holding up well, too. Sales of refrigerators, ranges, freezers, and washers are expected to stay about the same, while air conditioners will continue 'way up.

Gaging Business . . .



PRICE INDEX

	APR '54(*)	MAR '54(p)	FEB '54(r)	MAR '53
Total Index	**132.6**	**132.8**	**132.8**	**129.6**
Metalworking Machinery	**142.0**	**142.0**		**137.9**
Other Machinery exc. Electrical	**137.6**	**137.5**		**132.8**
Electrical Machinery	**132.0**	**132.0**		**124.8**
Fabricated Metal Products	**129.0**	**129.1**		**127.6**

(*) Estimated (p) preliminary (r) revised

March business wasn't up to scratch. Normally it should show a higher level of activity than February because of more working days, better weather, Easter business.

But this year, March failed to show any appreciable gain over February.

However, some signs point to a slowdown in the business downtrend. But it still isn't too evident that things will take a turn for the better soon.

• • •

There were only 50,000 more jobs in March than in February — less than the expected increase. And the number of unemployed is about 800,000 under a year ago.

• • •

Production worker unemployment increased in March. Some 12.7 million factory workers were employed in February, 12.8 million in January. March's total: 12.5 million.

March was the seventh consecutive month to show a dip in manufacturing employment. Last March, factory production workers totaled 13.8 million — about 1.3 million more than are employed today.

• • •

Gross National Product (total value of US goods and service output) averaged $359 billion in first quarter 1954, representing a 1% drop from fourth quarter 1953, and a 3% drop from the all-time-peak second quarter 1953. The decline from the fourth quarter rate is because of lower inventory investment and federal spending.

Industrial output declined 1 point in March to 123 (1947-49 = 100).

Reason for the drop is the reduction in durable goods output. Non-durables held up very well but production in general was off 9% from March 1953.

And you can look for a further cutback in industrial output for April. Reason: soft goods production is dropping rapidly.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49 = 100)*	120.5	120.4	132.8
Steel ingot operation (thousands of tons)	1,604	1,622	2,228
Electric power output (million Kilowatt hours)	8,396	8,463	8,001
Production of automobiles and trucks	152,262	146,498	176,783
Engineering construction awards (*Eng. News-Record*—millions)	$306.6	$314.3	$275.0

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production (1947-1949 = 100)*	123	124	135
Index of durable manufactures production (1947-1949 = 100)*	135	139	155
Durable goods manufacturers' sales, millions*	$11,366	$11,580	$12,666
Electrical machinery manufacturers' sales, millions*	$ 1,303	$ 1,328	$ 1,362
Other machinery manufacturers' sales, millions*	$ 1,946	$ 1,959	$ 2,158
Durable goods manufacturers' new orders, millions	$ 9,531	$ 8,475	$12,416
Electrical machinery manufacturers' new orders, millions	$ 1,268	$ 987	$ 1,303
General machinery manufacturers' new orders, millions	$ 1,504	$ 1,378	$ 1,959

* Seasonally adjusted

✓SAVE UP TO 40% SPACE!

✓EXTRA HIGH SAFETY FACTOR!

✓DEPENDABILITY . . . backed by 38 Years of Know-How!

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SPACE SAVED
T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

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NEW T-J

Spacemaker AIR CYLINDERS

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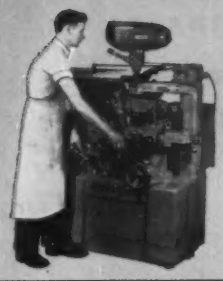
RIVETORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS

SHEFFIELD MACHINE TOOLS

guard *PRECISION* in the shop

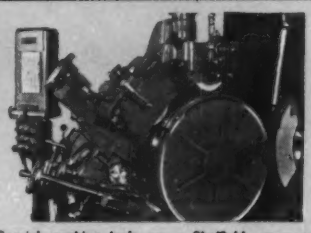
Micro-form Grinder, Model 121 grinds high precision profiles both flat and circular directly from large scale drawing, saving up to 75% over conventional practice. ☐



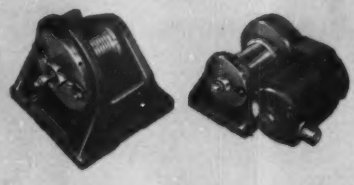
Micro-form Grinder, Model 122 equipped with a combination 30 power microscope and viewing screen. ☐

Thread and Form Grinder, Model 133 uses the multi-ribbed wheel principle to grind small precision threads and intricate forms on a high production basis. ☐

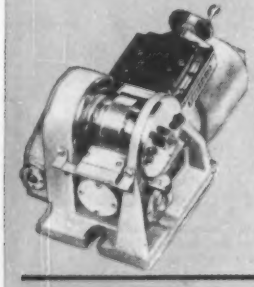
Precision Thread and Form Grinders —100 Series, produce precision threaded elements and cylindrical forms by the Crushtrue method, the diamond dressed multi-ribbed wheel or the single point wheel method. ☐



Special machine tools are a Sheffield specialty, such as this one of 12 jet turbine shroud grinders placed in operation within the last six months. ☐



Idler and motorized type Crushtrue devices are available for forming grinding wheels on standard surface grinders. ☐

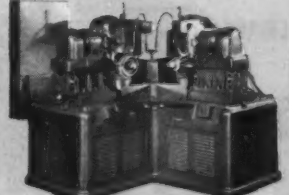


Self-truing Motorized Crushtrue Device forms surface grinder wheels for the grinding of flat form tools, etc. of the highest precision and uniformity. ☐

The Sheffield Crushtrue Roll Bank plan provides Rolls for production use while worn rolls are enroute to Sheffield for re-grinding and re-ground rolls are enroute from Sheffield for use. Nominal exchange charge. ☐

Gear and Spline De-burizers deburr or chamfer up to 600 gear teeth per minute. Applicable to spur, helical, hypoid, bevel and herringbone gears —also multi-start worms. ☐

Gear and Spline Chamfering Machines chamfer, burr or recess the ends of gear teeth at high production rates—ideal for short runs and quick changeover. ☐



Style "C" Gear and Spline Chamfering machines have two cutter spindles and two workheads for mass production gear manufacture. ☐

Sheffield is prepared to produce precision threaded elements and formed parts on contract to augment your own manufacturing facilities. ☐

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6539

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

What Regularized Replacement Can Do

"Cost control is the most important problem for us and for all business in 1954." So states the Foster-Wheeler Corporation.

Perhaps that is the chief reason why metalworking companies, and all manufacturing industries, intend to spend more of their capital outlay for replacement and modernization from now on.

Last year, manufacturing companies used 52% of their capital expenditures for replacement and modernization. This year the share for modernization will go up to 57%, according to a survey made by the McGraw-Hill Department of Economics.

The upward trend will continue the next few years. In the 1955-1957 period, the share for modernization will rise to 61%. The ratio in Metalworking will be even higher.

In electrical machinery, for example, only 39% of the 1954 outlay will be for replacement. But over the next three years the percentage will climb spectacularly to 62%. In the automobile industry, the shift will be even more pronounced. Some 64% of this year's capital spending will be for modernization. The ratio will turn sharply upward to 70% in 1955-1957.

Cutting costs, as modernization does, frequently means cutting labor costs. The savings show up in higher output per worker. And don't forget that productivity must continue to rise as long as labor's hourly wage goes up.

All of which seems to explain rather well the interest currently being aroused in the subject of replacement and modernization.

It is to be the theme of a two-day conference of the American Management Association in New York on May 3 and 4. It was the topic of a one-day meeting of the New England Council in Boston on April 22. No doubt other well-known business and industrial associations will stage similar sessions.

This surge of interest in regularized replacement is heartening, and yet not surprising. Competition is upon every metalworking industry in a big way. Soft times are at an end. More goods for more people at lower prices once more is likely to become a meaningful slogan.

We venture the opinion that interest in regularized replacement will flourish and not wilt in the future. There is a sound reason for this prediction. Practical yardsticks, like the MAPI formula, have been developed to measure the profit or loss from replacement of production equipment. Management no longer has to depend upon guesswork.

As regularized replacement becomes part and parcel of the management policy of more and more companies, you will be foolish indeed if you do not look at it seriously with an eye on the benefits that it can bring to you. For regularized replacement, done on a scientific basis, can do a lot for you in keeping costs down to a reasonable level.

Burnham Finney

extra clamping surface here for the bulky casting!

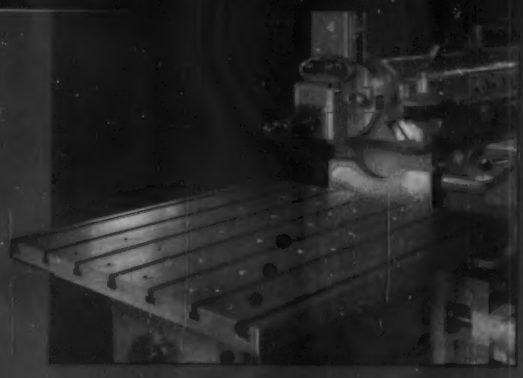
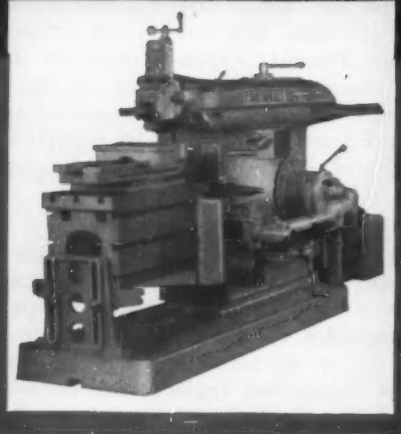


Photo courtesy of Morton Machine Tool & Supply Company.



Cincinnati Shapers with large area Cincinnati Supplementary Table Tops allow firm clamping of heavy bulky castings. These tables are a profitable accessory.

Set-up time is reduced, and more accurate cutting results from the firm clamping. It widens the use of a Cincinnati Shaper and is easily attached.

The versatility of a Cincinnati Shaper, "The handy man of industry", makes it a busy profitable tool in the shop.

Write for complete Catalog N-6.

THE CINCINNATI SHAPER CO.

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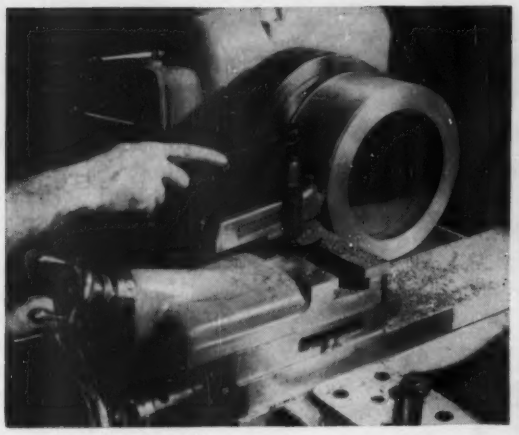
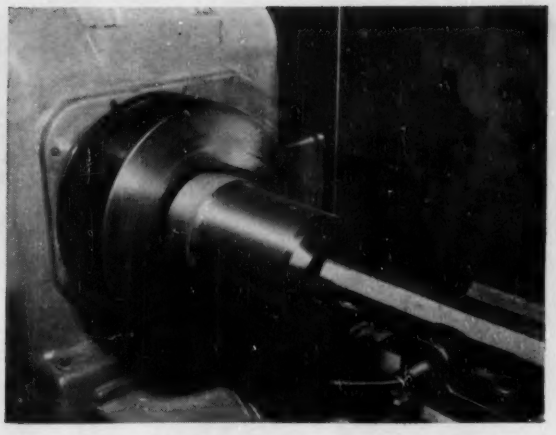
CINCINNATI





HIGH SURFACE SPEEDS, FINE FEEDS, and sharp tools produce good finishes and small chips when powder-metal parts are machined

MACHINING POWDER-METAL PARTS IS EASY, IF....

American Machinist

- ► **Tools are dead sharp**
- ► **Clearance and cutting angles are correct**
- ► **High speeds and light feeds are used**

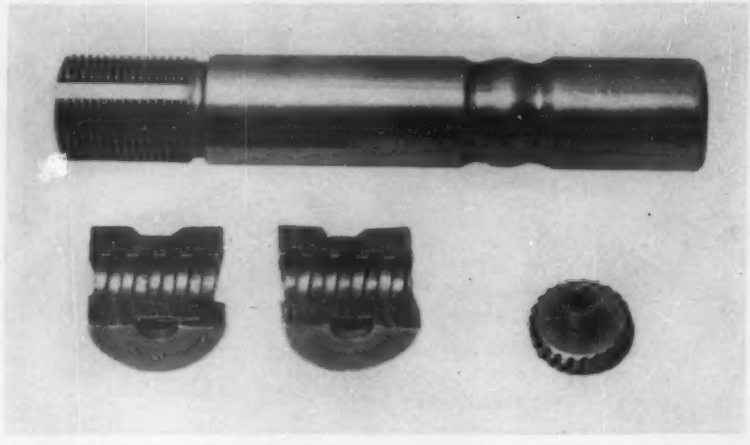
A J LANGHAMMER, president; and PHILLIP GLICK, staff executive: AMPLEX DIV, CHRYSLER CORPORATION

Powder metallurgy's important advantage in some cases is in eliminating machining, but when tapped holes, annular grooves, and other shapes that cannot be pressed are needed, then machining is often the only way. Here is how to machine relatively porous powder-metal parts

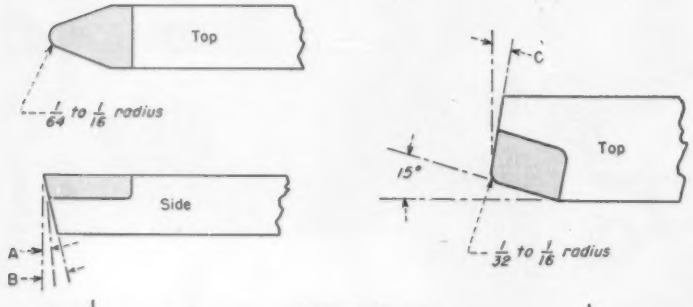
MACHINING is really incompatible with the principal objective of powder metallurgy, which is to mold powders directly into dimensionally accurate finished shapes. But there are times when the shapes of parts do not permit fabrication to their final form by powder-metallurgy methods. Normally these are minor, and include threads, re-entrant angles and grooves, side holes, and undercuts. None of these can usually be produced in a part with conventional briquetting equipment and tools.

In addition, a large amount of cored and solid bar, as well as strip, circular, and plate stock made by powder metallurgy, is machined into bearings and other machine parts to gain the advantages of the self-lubricating properties of the material.

Drilling, tapping, boring, turning, and all the other conventional machining operations are performed daily on sintered metal-powder parts, even though such parts are frequently considered to have poor machinability because of their inherent porosity or because of improper porosity. This porosity, a great advantage otherwise, causes discontinuous chip formations and continuously subjects the cutting edge of the tool to shock and impact when it passes over the pores and re-enters the metal. Consequently the cutting edge of the tool may be quickly



MACHINABILITY OF SINTERED METAL POWDER is evident from these samples. Bar has been turned, threaded, milled, and grooved. Nut (cut apart) is for a hospital bed; has been Acme-threaded. Worm gear was machined from "Oilite" blank, then pressed onto steel hub



MATERIAL	CUTTING ANGLES					CUTTING SPEED SFPM
	A Front Clearance Tool	B Front Clearance Shank	Side Clearance Tool	Side Clearance Shank	C End Cutting Edge	
Bronze Oilite	4°–6°	7°–10°	7°–8°	10°–13°	5°–7°	350
Super Oilite	7°–8°	10°–13°	7°–8°	10°–13°	5°–7°	350
Iron Oilite	7°–8°	10°–13°	7°–8°	10°–13°	5°–7°	350

RECOMMENDED CARBIDE-TOOL DESIGN is specific on nose radius, cutting angles. Roughing tool is only one of a number that will work efficiently. "Oilite" materials tabulated are all oil-impregnated, and must be cut with dead-sharp edge to retain porosity on surfaces

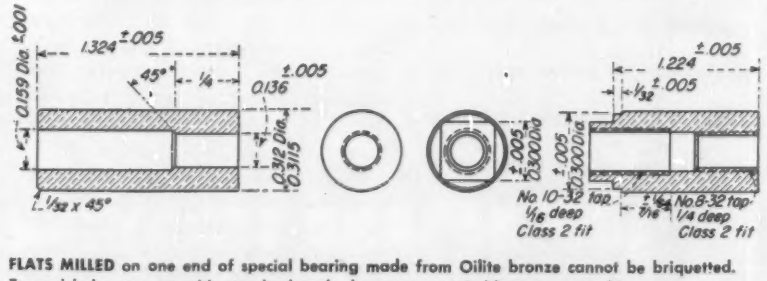
dulled, resulting in rough finishes. In the case of bearing surfaces of oil-impregnated parts, the greatest danger of a dull tool is in smearing the surface, thereby closing up interconnecting pores and preventing the flow of oil from inner pores to the bearing surface.

Machining no real problem

Actually, finish-machining sintered powdered-metal parts is easy if dead-sharp tungsten-carbide cutting tools are used with high speeds and fine feeds. Turning and boring speeds run around 350 sfpm or more, and feeds about 0.001 to 0.005 ipr with a carbide tool having a nose radius of 1/64 to 1/32 in. For a tool with a nose radius of 1/16 in., the feed may be increased to 0.010 to 0.015 ipr. In any case, the nose width must be broad enough to overlap the width of the feed. Diamond-tipped tools produce excellent results, but their use is economically limited.

Although the harder grades of tungsten carbide are recommended because of their resistance to abrasion, HSS toolbits may be used when only a few parts are to be machined, particularly for roughing. For turning and boring with HSS, cutting speeds of about 100 sfpm are acceptable. It is always necessary to employ fine feeds to obtain a smooth surface, and where porosity of the material must be maintained for self-lubrication, it is essential that cutting tool edges be kept dead sharp. Type or shape of the cutting tool is of secondary importance, provided only that it has a rounded nose and correct cutting angles.

When roughing is performed, or where surface porosity is not a requirement, speeds up to 600 sfpm and feeds up to 0.030 ipr may be used with tungsten-carbide tools.



FLATS MILLED on one end of special bearing made from Oilite bronze cannot be briquetted. Tapped holes are cut with standard tools; low-pressure air blast removes chips

Diamond-tipped tools permit even higher rates.

The same recommendations apply to shaping and planing. Tools are ground with the same clearance angles as those employed for turning and boring, except the heel relief (angles A and B in the sketch) may be reduced to 2° if feeds are too coarse to provide a smooth surface finish.

HSS may be used in drilling with an approximate surface speed of 70 sfpm; however, 200 sfpm can be used with drills having carbide-tipped cutting edges. Because of uniformity in the rate of feed, power feeds are preferred over manual. The following feed rates may be useful as a guide:

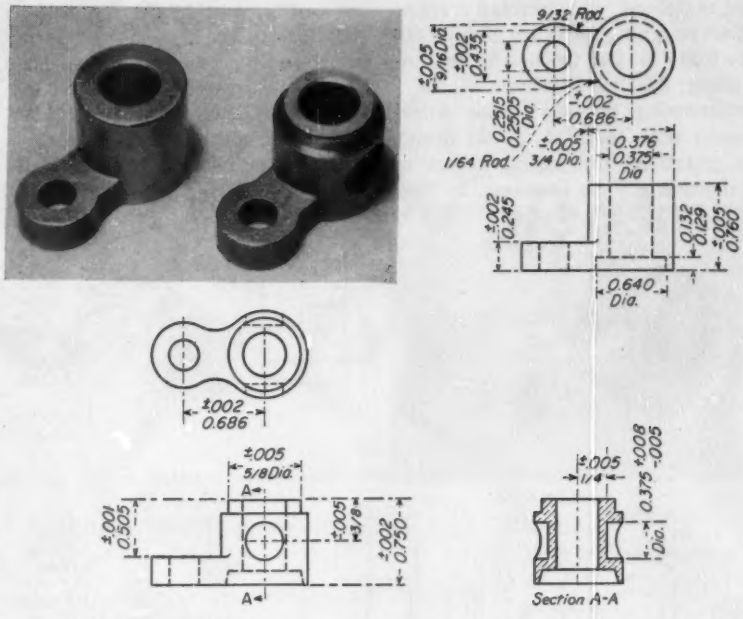
Drill Dia, in.	Feed, ipr
1/8 - 1/4	0.002-0.004
1/4 - 1/2	0.004-0.006
1/2 - 3/4	0.006-0.008
3/4 - 1	0.008-0.012

Tapping is easily accomplished and standard carbide taps should be employed for high-volume production. Conventional tap-drill sizes are used to obtain 75% full depth of thread. If difficulties are encountered, the relief of the tap can be increased to nearly twice that used for tapping conventional ferrous materials.

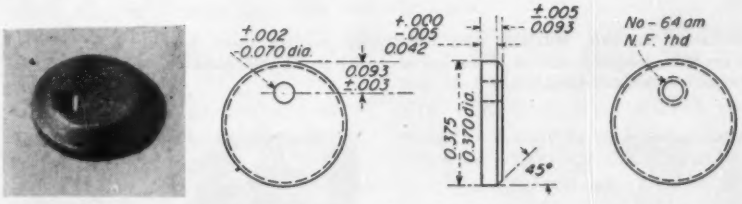
Coolants detrimental

The use of ordinary coolants like water or cutting oils is not recommended on sintered parts because they mix with the impregnated oils, and in ferrous parts may cause corrosion. When necessary for cooling and flowing away chips, a volatile coolant may be applied. It can be removed later by heating the parts to the point where it leaves as a vapor. Low-pressure air blasts are best for removing chips and serve the added purpose of cooling the tools. This is especially recommended for oil-impregnated materials. All machined bearings should be reimpregnated as a safety measure because heat and centrifugal force cause some oil loss.

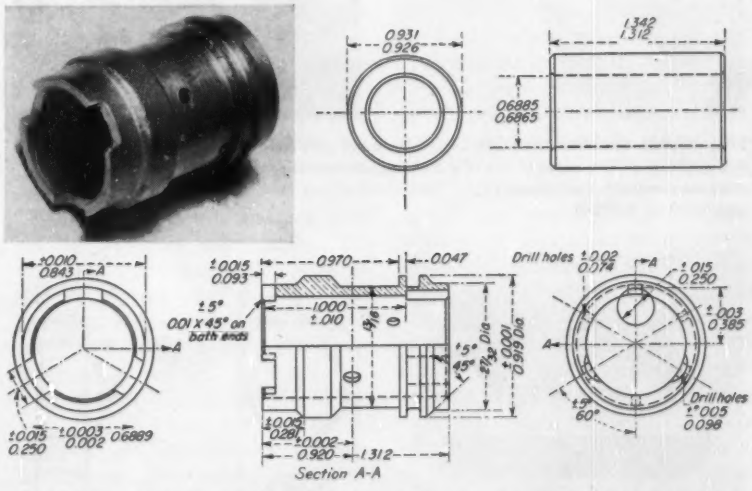
In milling, cutting speeds of 250 to 300 sfpm can be used with carbide tools, whereas 70 sfpm is recommended for HSS cutters. Helical teeth provide the best means of chip disposal. Tools should be ground with minimum corner radii



TWO BLIND HOLES are drilled into sides of business-machine parts made from "Oilite" bronze. Step is turned on hub and length faced to hold 0.750±0.002 and 0.505±0.001 dimensions



FINE THREADS are tapped in tungsten-copper balance weight for an instrument. Hole originally briquetted in part was standard tap-drill size for 2-64 thread



COMPLICATED PISTON SLEEVE for a pump is made from simple iron Oilite bearing stock by facing, turning annular grooves, boring to close tolerances, milling slots, drilling small side holes, and end milling blind internal grooves. Self-lubrication makes piston work better than conventional bar stock

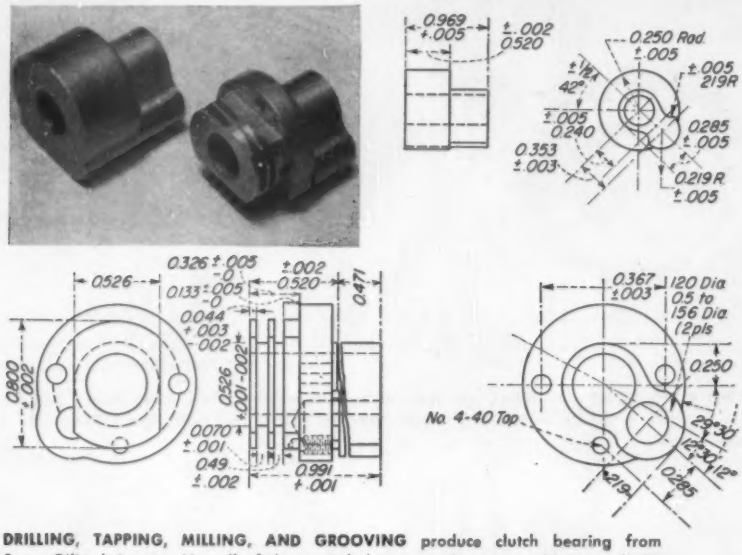
or, better yet, with beveled corners. Best roughing feeds are about 0.002 to 0.005 in. per tooth, and for finishing; 0.001 to 0.002 in.

Reaming bores to close tolerances with tools of special design is practical, but sizing arbors or burnishing tools cost less. In fact, an ordinary standard mandrel is satisfactory as a sizing arbor for short-run production. Finishing stock not larger than 0.001 to 0.003 in. on the dia. is normally allowed for sizing, although more stock is allowed for bearings of larger diameters. Bearing sizing tools are particularly well suited for sizing to close tolerances and just a little stock should be left for finishing with these tools. Usually less than 0.0005 in. on the bore dia is recommended.

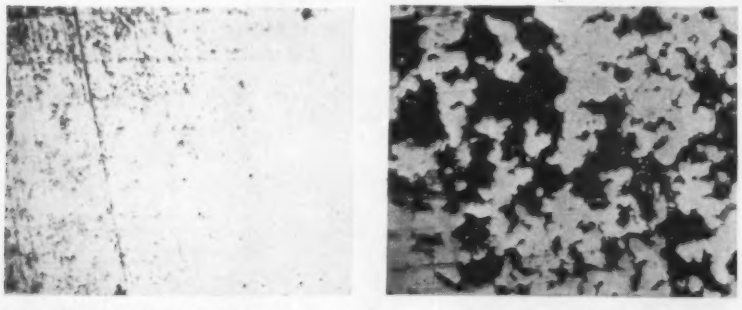
Because of the importance of maintaining bearing-surface porosity, burnishing is generally considered to be safer than reaming. Burnishing tools can be of the button type, left-hand-spiral, or the roller type for high production. Any of these, made of HSS, will produce satisfactory finishes and are recommended for holding bore tolerances of 0.0005 in. or less. The less stock left for this operation the better, which reduces the possibility of closing surface pores. Usually 0.002 on the diameter is considered to be maximum.

The practice of burnishing to finish a bore is often challenged in the metalworking industry; however, in the production of Oilite bearings, every bore is finished with sizing punches or arbors with excellent results. Normally the burnishing tool is 0.0002 in. larger than the finished size required. For example, if the bore is to be 1.000 in., the burnishing-tool dia should be 1.0002 in.

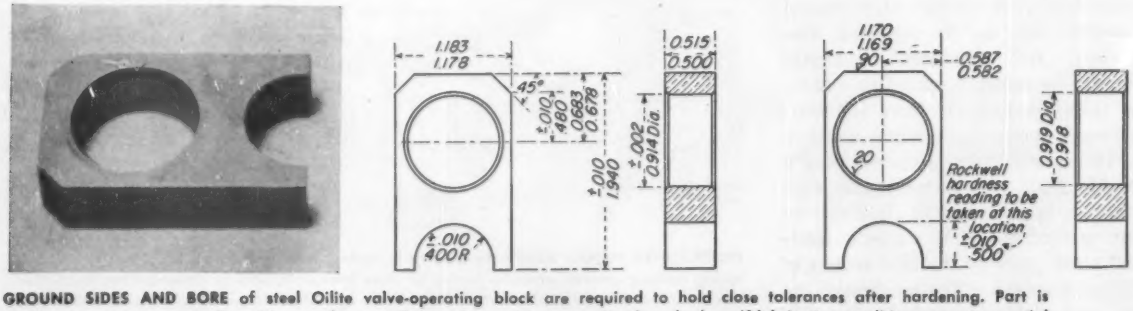
Grinding and lapping are widely used for maintaining close tolerances but they are not recommended for bearing surfaces because they tend to close up pores. Where porosity is not a requirement, and for especially hard powdered metals such as Chrysler's Super-Oilite-16 and Railite, either or both operations may be performed. Hard, fine wheels run at conventional speeds with light feeds are recommended. A light-bodied oil should be used to flush abrasive particles away.



DRILLING, TAPPING, MILLING, AND GROOVING produce clutch bearing from Super-Oilite briquette. Not all of the special shapes on the part could be made by briquetting without machining



DULL REAMER SMEARED THE BORE in powder-metal part (left), ruining self-lubricating qualities of the material. Dead-sharp tungsten-carbide reamer produced open pore structure with black areas (right) from which oil can flow freely. Stock removed was 0.002 to 0.005 in.



GROUND SIDES AND BORE of steel Oilite valve-operating block are required to hold close tolerances after hardening. Part is produced more economically with powder metallurgy than with conventional methods; self-lubricating qualities are not essential

Try pleasing your boss

Working for a company is working for a boss — and making him like it. The old remarks about "apple-polishing" don't fit any more

E J ENGLE, personnel director, M & S MANUFACTURING COMPANY, HUDSON, MICH

You spend more waking hours at work than any other single place, so it should be important to you that you make working hours as pleasant as you can. There's only one sure way to do this—do what your boss wants you to do. Because that's the only reason you're being paid.

What does the average boss want? All the different things he wants from you can be expressed in one word—loyalty. Loyalty to the boss, to the company, and to the customer. Loyalty to the customer is rather a new idea, and is really part of loyalty to the company, but it's being given new emphasis, because a satisfied customer is absolutely necessary to continued sales. Loyalty to the company means such things as job stamina, ability to get along, and an honest desire for self-improvement. But as far as you and your boss are concerned, your first requirement is loyalty to him.

How do you go about developing loyalty to the boss? First, figure out what your boss is like. What does he like and dislike? What are his strong and weak points? Is he a stickler for detail? Is he fussy about housekeeping? You can add to the list, and when it's finished, remember—as long as you're being paid to do a job, it's up to you to follow the needs of the boss. Too many people insist that their own personal requirements come first, then come the job's requirements. Such people usually find out too late that when you're working for someone else, his needs are first, not yours.

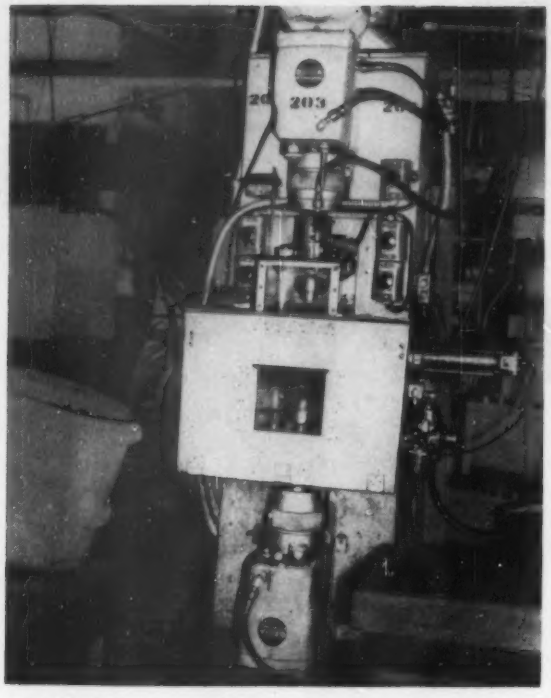
When you've figured out what your boss is like, act accordingly. In the early stages of the "enterprise" system in this country, there was a lot of unfortunate ridicule about "apple-polishing," which was often confused with noticing in advance what work the boss needed done and supplying the effort to do the work without being told. This skepticism toward self-starting was a more or less natural result of putting people from a highly individualistic economy into the position of working for someone else.

This doesn't mean that you have no right to your personality. The rules of "individualism" apply today as always, except when "being yourself" means you do your job less efficiently than you could do it.

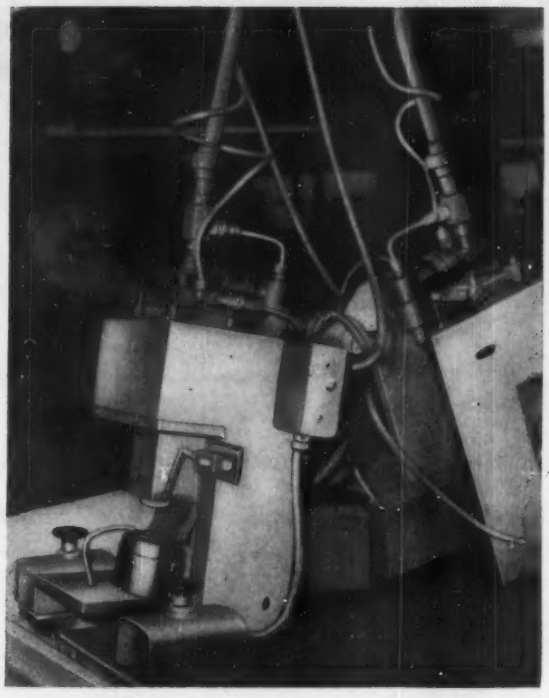
Neglect of this basic rule of human nature has led to untold friction and unnecessary job dissatisfaction. Put yourself in your boss' shoes and try to see how he'd react when you apply these principles. You'd certainly appreciate a willing, loyal worker, and resent a stubborn dissenter. Common sense, of course, but common sense is sometimes awfully uncommon.

Remember that your boss' needs are bigger than yours. You may feel like your problems are important and your boss doesn't pay enough attention to them. If so, think for a moment how many people like yourself are making the same sort of demands on his time, and don't feel sorry for yourself if you don't get the immediate action you had hoped for. The variety of your boss' problems would probably amaze you.

One final point: If there's any doubt in your mind about your own performance, try to find out your own job weaknesses. The best place to do this is right in the boss' office. Chances are there are some ways you could easily improve your work, and, in so doing, fortify your job position. It could do you a great deal of good if you found out that some habit or habits irritated your boss—such things as too much or too little talking, excessive temperament or a lack of enthusiasm, incorrect or inadequate answers to questions, improper grooming, or similar, easily corrected faults, of which you may be completely unaware. Diplomatic questions may bring these points out in the open, to your advantage.

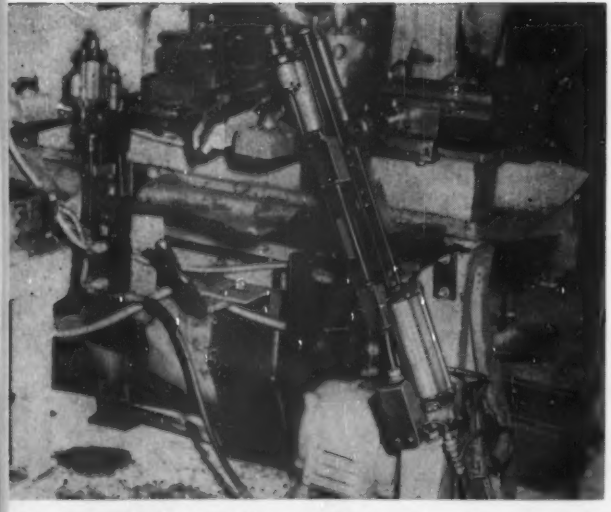


TWO DRILL SPINDLES are fed up and down at this special facing and reaming machine by air cylinders attached to the drill heads. Air jet blasts cutters as they start to feed toward work to clean off old chips. Operation of machine is automatic except for loading parts



LOCKSET PARTS are assembled and staked on air-cylinder machine where air provides power and cushions stroke. Original and operating costs on the machine are less than for small punch press, and operation is faster

Air-Power

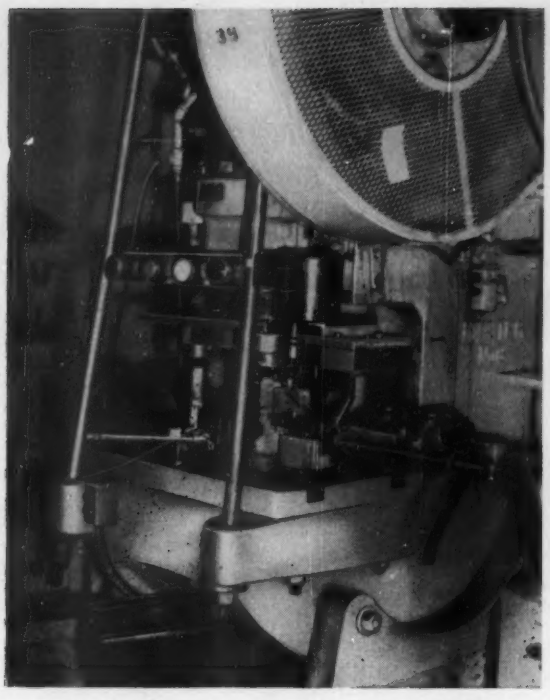


TURRET LATHE is fed by air cylinder, which replaces tiring hand effort and increases speed of machine operation. Air cylinder can also operate lathe chuck

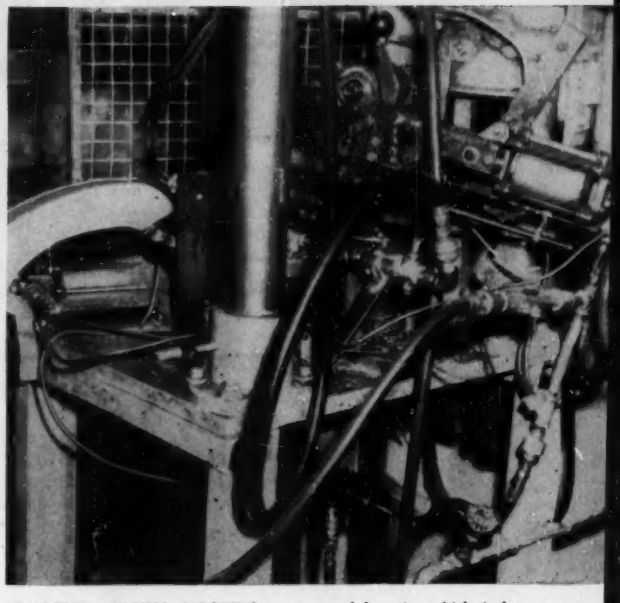
Well over 200 machines at Kwikset Locks, Inc, Anaheim, Calif, are air-actuated or air-powered in some way, including both standard machine tools and some special-design equipment made for air power. Principal applications are for feeding tools, indexing fixtures, ejecting finished parts, and cleaning machines and tools

Compressed-air power for the Kwikset system is supplied by a vertical, two-stage, 800-cfm compressor, augmented for peak loads and for night operation by a 100-cfm single-stage compressor. Both deliver 100 psi. A separate system in the plant takes 200 psi, so two 360-cfm (one of these is illustrated) compressors are operated to power die-casting equipment. The higher pressure is needed to move die-closing cylinders and ejection cylinders on 12 machines.

One particular advantage of the air systems as



PUNCH PRESS is fitted with controlled air jets to eject work after stamping. Air clutch is also fitted to press to prevent damage to punch and die



HIGH-SPEED FACING MACHINE is powered by air, which indexes table, feeds cutter, and ejects lockset plugs when they come opposite chute

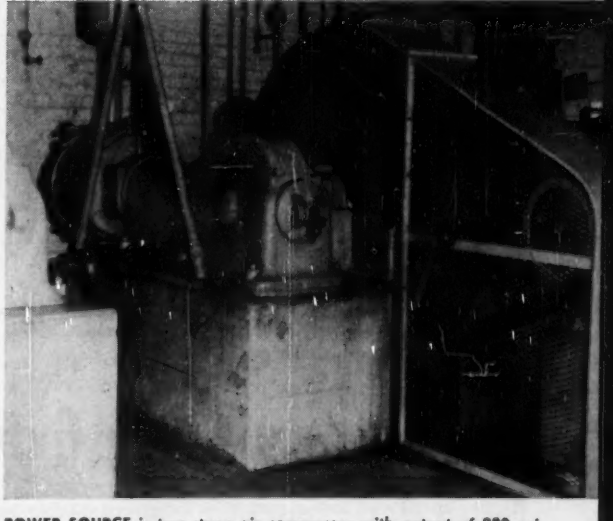
makes locks quicker

applied in this plant is the low maintenance requirements because of the small number of moving parts. Versatility of air power, as applied to so many machines for different purposes, is also evident.

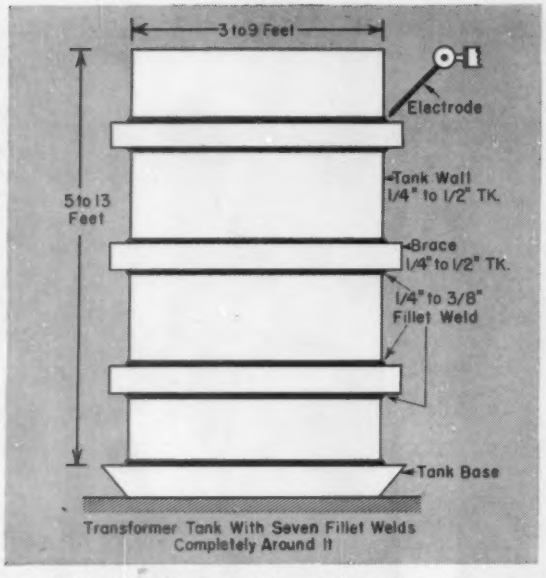
On the other side of the ledger, air losses can be expensive. A 1/16-in. hole will lose 182,000 cu ft of air a month, and that would add up to a loss of nearly $12. Therefore, regular line inspections are made, as are pressure checks.

Air pressure is affected by friction losses in the line. A 3-in. line 1000 ft long will carry 500 cfm with a pressure loss of 2.5 psi. But a 4-in. line will carry twice the air with the same loss. Although initial expense is higher, savings over the years will pay for installations of larger lines where possible.

Outstanding advantages of air power in the plant have been the ease with which machines can be operated continuously, the application of practically foolproof toolfeeds, and the setup of tool cleaners that extend tool life.

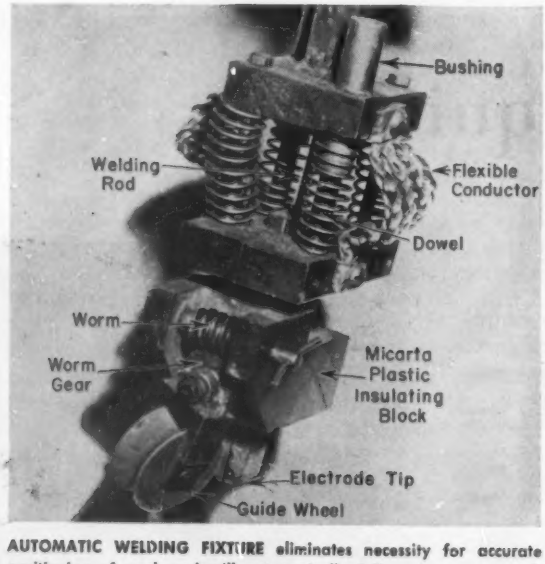


POWER SOURCE is two-stage air compressor with output of 200 psi at capacity of 360 cfm for two units. Compressors are paired, with one working, one in reserve, to reduce wear



TYPICAL TRANSFORMER tank with seven fillet welds made at 33 ipm. Welding time has been reduced 75%, as against manual operations

Hills and dales mean nothing to...



AUTOMATIC WELDING FIXTURE eliminates necessity for accurate positioning of work and will automatically follow a seam, regardless of irregularities

Automatic welding fixture

Higher speed and lower cost, plus improved quality and appearance result from application of newly developed submerged-arc welding fixture which eliminates need for costly positioning

ASA M TROYER, DAN LORAIN, JR
WESTINGHOUSE ELECTRIC CORP
SUNNYVALE, CALIF

Development by Westinghouse of a new, automatic welding fixture has made possible submerged-arc welding of non-positioned fillet welds on large steel fabrications previously welded only by hand, and has resulted in reduced welding costs and improved quality.

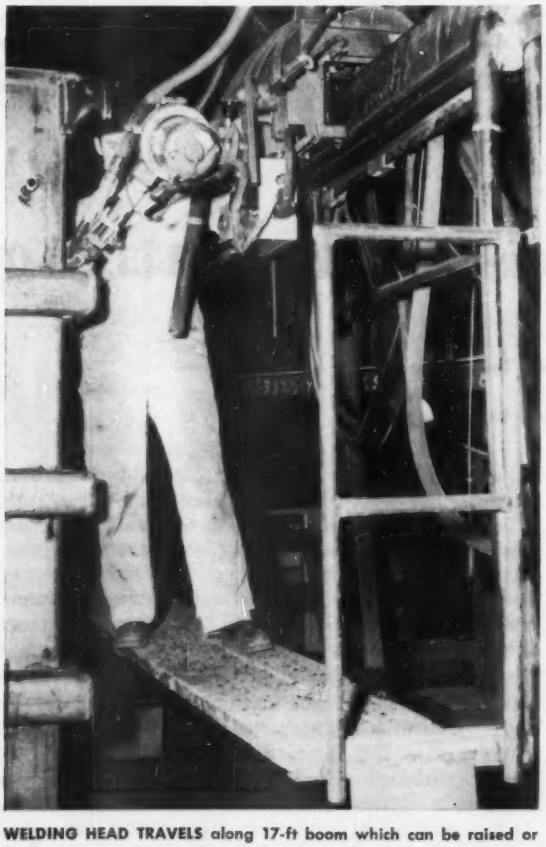
Thus far, the fixture has been used mostly for straight-line welding where the work is large and fixed, the electrode moves, and seams are vertical and horizontal. However, it can be applied with equal success where the work rotates or moves in a straight line and the welding head remains stationary. It can be used also on lap welds, and on fillet welds it can be applied wherever the electrode is held in the range of ± 60° from vertical.

DESIGN REQUIREMENTS

The fixture was designed originally to permit automatic welding of horizontal braces for large power-transformer tanks, and had to meet these design requirements: 1) It must eliminate necessity for accurate positioning of the tank. 2) Because the normal curvature of large sheared and formed plates may be concave or convex, it must be able to retract automatically from any convex side and expand toward the concave side to insure a proper weld deposit throughout the length of the seam. 3) It must be adaptable to a standard automatic welding head that can be rack-mounted and motor-driven at a constant speed. 4) Normally, the opposite ends of any non-positioned seam may vary from ¼ to ⅜ in. in height; however, for proper weld deposit, the electrode tip must follow the seam within at least 1/16 in. Thus, to eliminate leveling of each seam, the fixture must be able to float or follow any seam up and down or in and out to at least 1/16 in.; 5) A quick and precise line-up of electrode tip at the start of the seam must be provided, and the weld must be automatic and proceed without attention from the operator.

The new fixture is adaptable to a standard ac or dc automatic-welding

BRACES ARE WELDED to transformer tank by attaching the new fixture to a standard submerged-arc welding head which travels along a rack rail



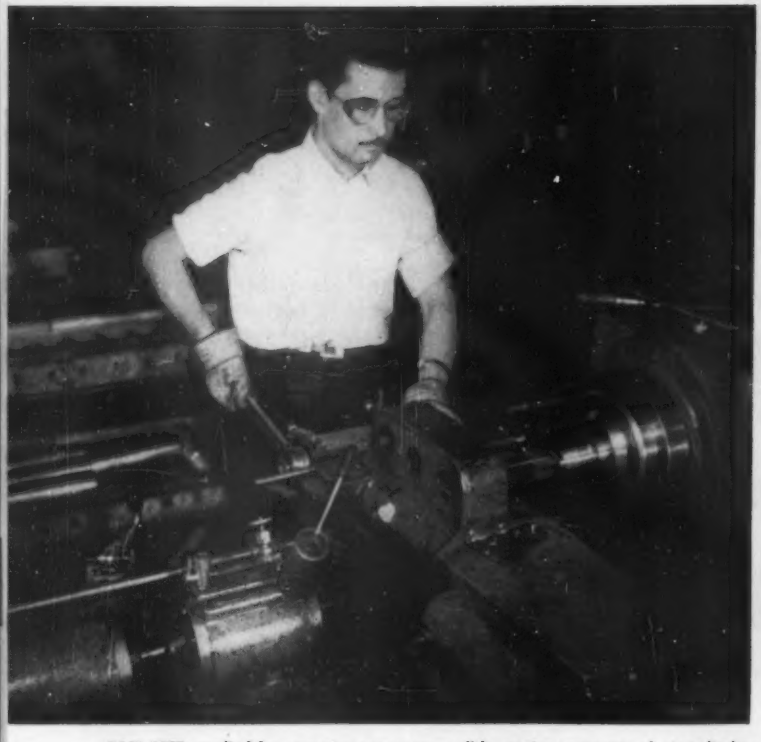
WELDING HEAD TRAVELS along 17-ft boom which can be raised or lowered to suit the position of the seam. Work can be rotated on turntable

head. The standard electrode is split into two parts, and a sliding-dowel mechanism, with springs in compression, is inserted. Current is carried over the gap by a flexible cable. A guide-wheel assembly, attached to the lower half-electrode, consists of a Micarta laminated block that supports a grooved guide wheel and a gear-and-worm assembly. The guide wheel, made of hardened steel, rolls in the seam being welded and guides the arc and weld deposit that follows. The wheel rides with one edge on the vertical leg and the other on the horizontal leg of the seam. It is grooved to ride over tack welds. The gear and worm assembly with its small handle enables the operator to give a quick, minute adjustment after the guide wheel is placed in the seam and is under spring tension. A twist of the handle moves the electrode relative to the guide wheel to bring the electrode tip into exact alignment in the seam. Thereafter, this exact relationship is held by the guide wheel with no further attention from the operator. Operation is automatic, and the wheel and electrode follow the seam regardless of plate or fitup inaccuracies, and regardless of misalignment caused by rough setup.

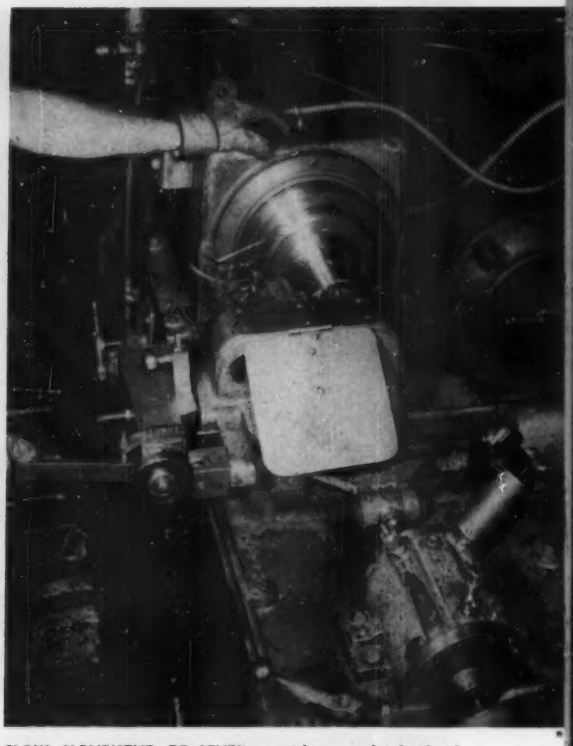
WELDING PROCEDURE

The tank to be welded is placed on a turntable in front of the welding-frame assembly. The turntable is rotated by hand and clamped when the work is roughly lined up. The welding frame assembly is moved forward, and the boom raised or lowered to bring the fixture vertically in position with the seam. The welding head and fixture are then moved along the rack rail to the initial point of the seam. The fixture springs are compressed half way and the guide wheel is placed over the seam. A minute adjustment is made with the gear and worm mechanism to bring the electrode tip into exact alignment. The arc is started and the welding head travels along the rack rail. The spring tension on the lower half-electrode forces the guide wheel to follow all the normal variations, ripples or warpages of the steel plate. Also, the wheel is forced to lead the electrode on any skew path (within the limits of the sliding spring and dowel movement) resulting from the rough initial alignment of the parts to be welded.

Use of the fixture has cut welding time by 75%. Transformer braces are now being welded at speeds of 33 ipm and are completed in one pass. In addition, quality of the weld is improved, and the unsymmetrical appearance of hand welds, caused by starts, stops, and overlapping beads has been eliminated.



CAM FEED applied by operator moves cross slide against pressure of air cylinder to make undercuts in nose and base ends of HEAT shell. Previously this feed was by handwheel



SLOW MOVEMENT OF LEVER provides steady feed of boring bit. Cam attached to lever acts against roller in cross slide located directly in front of air-cylinder piston so slide is not shifted on ways. Adjustable stop screw limits cam rotation

Cam feed speeds undercutting

Better control of feed rate, better finish, and less operator fatigue are added advantages of this modification to shell lathes

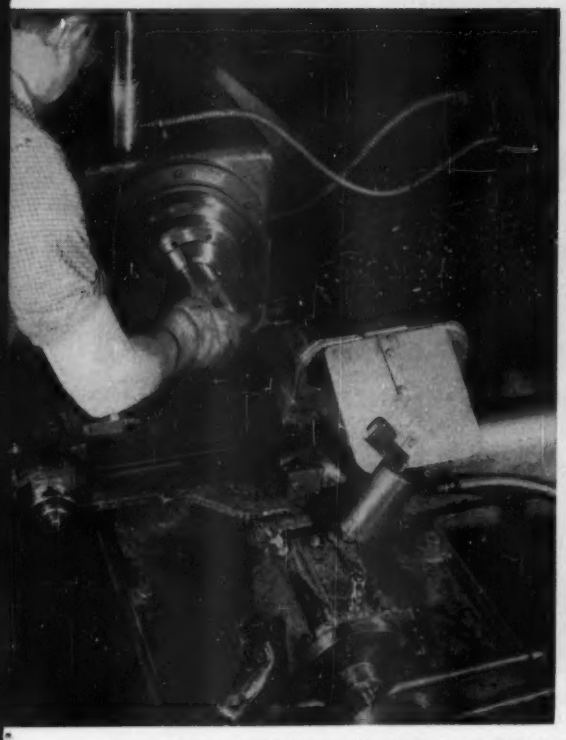
Nose and base ends of the 75-mm high-explosive anti-tank (HEAT) shell made for the Ordnance Corps on a recent contract had to be bored and undercut concentrically within close limits. These operations were performed in specially tooled Type A Hepburn shell lathes, which now are being converted for machining another type of shell.

Separate lathes were tooled for operations on the two ends of the shell, and in each case the operations were divided between two stub boring bars equipped with carbide-tipped bits. For all of these operations, the 7½-hp lathes were operated at 450 rpm and carriage feed rate was approx 0.012 ipr.

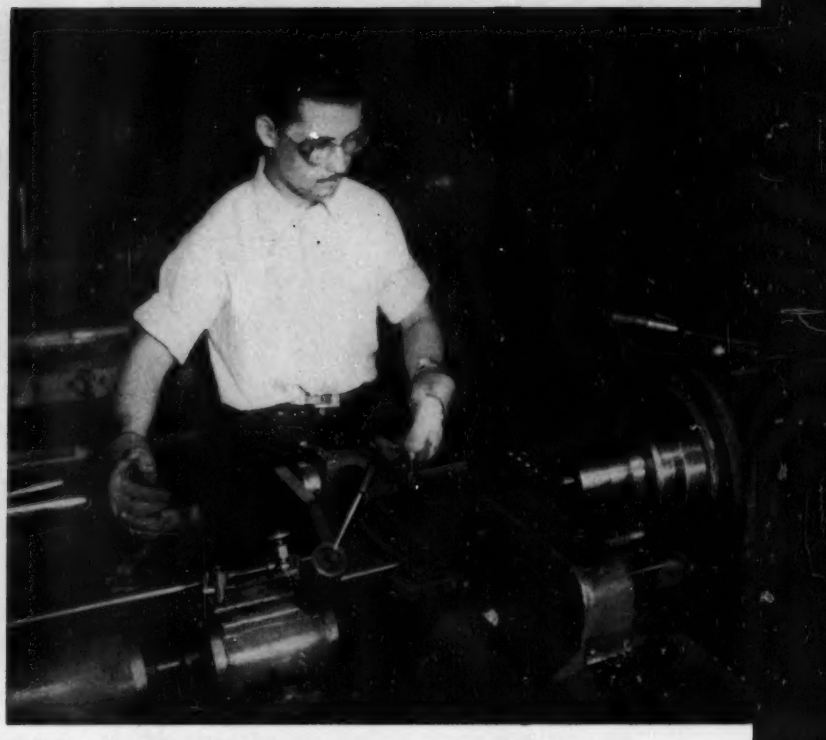
Movement of carriages and cross slides on Type A Hepburn lathes is accomplished with air cylinders, a hydraulic cylinder being connected in tandem with the carriage-feed cylinder to control the feed rate. Hinged positive stops are used to locate the cross slides quickly and accurately for centering the boring bars in proper sequence.

In each case, the lathes were tooled so undercutting operations in the nose and base ends of the shell were done with carbide-tipped bits in the second boring bar of the two-bar pair. These bars also carried bits for straight boring operations.

Undercutting was accomplished, after the bar had been fed to full depth and the carriage brought against a positive stop, by manually moving the cross slide back against the pressure of its air cylinder. In the tooling originally supplied with these lathes



LONG STROKE OF AIR CYLINDER pulls boring-bar holder out of the way for loading operations. Hinged guard on bar holder can be placed across bars when cutting to deflect chips downward



HINGED STOP is dropped into place as operator opens air valve to move cross slide into position for first cuts on base of shell

on 75-mm shell

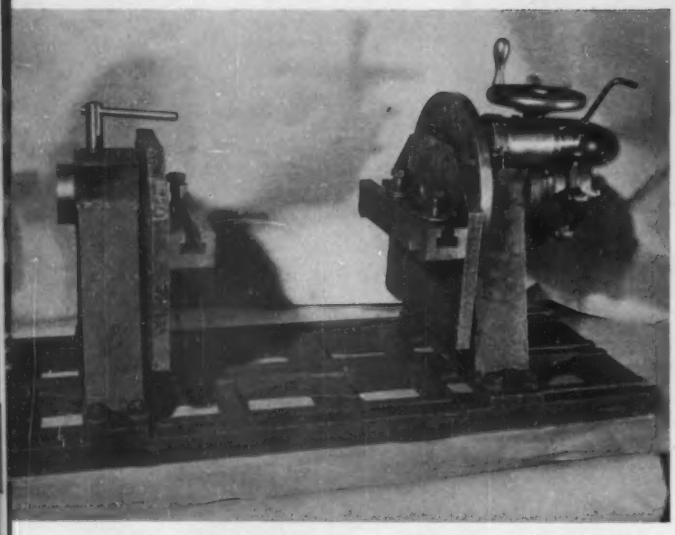
STEPHEN F PASTERNAK, chief engineer, PEERLESS OF AMERICA, INC, CHICAGO

this manual movement was accomplished with a hand wheel and feed-screw. This arrangement was slow, and tiring for the operators.

Replacement of feedscrew and handwheel with a lever-actuated cam on each lathe provided more accurate control of feed rate when undercutting, minimized operator fatigue, and resulted in better finishes on undercut surfaces. Devised by Peerless engineers and adapted to the first shell lathes received, these cam feeds later were supplied by the vendor so tooling revisions would not be necessary.

The hardened tool-steel cam had a rise of ¼ in. in approx 350° of rotation, cam radius increasing from 1½ to 1¾ in. in that distance. An adjustable stop screw was provided to limit rise of the cam lever and stop movement of the cross slide at the bottom of the undercut. One turn of this screw provided 0.001-in. adjustment of tool-point position.

With the cam lever in its lowest position, the cross slide was free to move forward against an adjustable positive stop in the stop block at the front of the carriage. This positioned the boring bar in the third block position central with the lathe spindle. Raising the cam lever then brought the cam against a hardened steel cam roller in a clevis directly in front of the cross-slide piston rod, so it acted directly in line with the pressure from the air cylinder and did not exert side pressure that would have caused the cross slide to turn in its guides and force the boring bar off center.



SMALLEST TRUNNION shows typical construction. Made of boiler plate, it has pedestals adjustable for length with T-bolt clamping. Side-plates can be mounted in different positions on index plates for height. T-bolts in side plate are adjustable for width to suit size of jig plate required. Index plate is rotated manually by a worm-gear drive and locked by cam-operated index pin

LOCATION ON FACE into which drilling is required is provided for pump cover. Work of this type would be difficult to locate accurately in any other way

New uses for trunnion fixtures

Trunnion fixtures for radial drills can reduce setup time, simplify your holding problems, and provide greater accuracy in jobbing work. Here is a simple, home-made fixture that can be adapted to a wide variety of jobs

These trunnion fixtures are constructed from boiler plate with a bed on which are mounted two A-frames that can be clamped at any desired point along the bed. One A-frame serves as the head and mounts an index plate shaft-connected to a worm-gear drive. Index holes at desired intervals (every 15° in our case) are jig-bored and bushed to position the index plate. The hardened and ground index pin is spring actuated to lock the index plate and has a cam-action release. A side plate attached to the index plate and a matching side plate on the tailstock A-frame are adjustable for height.

The fixture can be made in various sizes. Our smallest fixture is 4 ft long, 2 ft high, and 2 ft wide and is rotated by hand through a worm drive. Our largest fixture is about 6 ft long, 3 ft wide, and 4 ft high and is sometimes power rotated by the radial drill spindle through a tap driver and sometimes provided with independent motor drive.

Jig plates can be made in standard sizes to fit these trunnion fixtures. Work can be drilled in various planes with a single clamping. With the addition of an index plate to the jig plate any compound angle can be obtained.

Clamping is simplified, particularly with odd-shaped parts. Work can often be held on the surface to be drilled and the part can project through the plate.

With a single mounting, it is possible to drill and tap all holes in the piece. Slip bushings can be

TRUNNION ROTATION is accomplished in this case by power supplied from spindle of radial drill. A tap driver is attached to the worm-gear drive and serves as a friction clutch to avoid damage to machine should operator fail to release locating pin and unclamp tailstock. Independent motor drive for trunnion can be included when needed

GEAR BOX COVER is located and clamped to jig plate, then a top jig is clamped to work to locate drill bushings. Mating half of this gear box is clamped on other side of same jig plate locating on post projecting below plate

on your radials

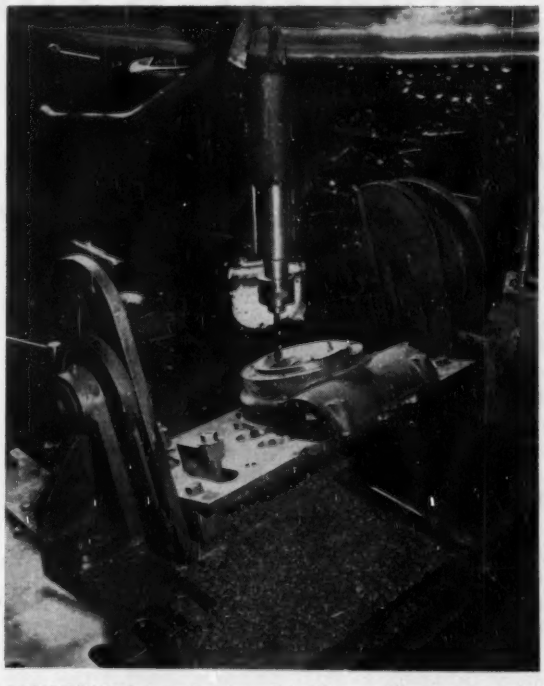
WALTER HUBER, supervisor
Small Pump & Turbine Dept
DE LAVAL STEAM TURBINE CO
TRENTON, N J

provided in the jig plates and removed for tapping operations.

Mating parts can frequently be drilled from the same jig plate, using one side of the plate for one half of the housing, the other side for the other half.

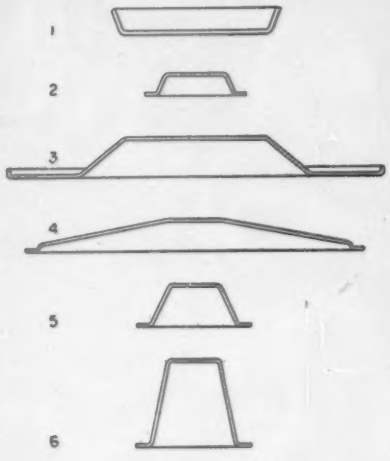
When jig plates with bushed locating holes are not required, the work can be mounted on straps between the side plates. Or, with such straps, box or other special jigs can be mounted.

To provide accurate level support of the trunnion fixtures, three bars are mounted on the floor alongside the machine base. Once these bars have been leveled and fixed, no adjustment is required. The weight of the trunnion fixture is great enough that no clamping to the leveling bars is necessary.



ANGLE DRILLING is easily accomplished by providing locating holes at desired angles in index plate of trunnion. For compound angles, an index plate can be mounted on the jig plate and provided with a circular T-slot for holding the work

RULES FOR DRAWING TAPERED SHELLS



1. Shallow, flangeless tapered shells (Fig. 1), with walls thick enough in relation to diameter to prevent wrinkling, can be drawn from a flat blank in one operation without a blankholder.
2. Shallow, tapered shells with small flanges (Fig. 2) with walls thick enough in relation to diameter to prevent wrinkling from overhang (space between vertical die wall and punch), can be blanked and drawn in one operation in a combination die.
3. Shallow, wide-flanged tapered shells with sufficient stock thickness and adequate holding surface can be drawn from a flat blank in one operation in an ordinary pressure-pad type drawing die, or they can be blanked and drawn in combination or double-action dies.
4. Large, shallow shells with little or no flange (Fig. 4) and a long-tapered body can be drawn in an ordinary pressure-pad type drawing die equipped with draw beads to stretch and retard the flow of metal. Square-sheared blanks should be used for die economy and to provide additional holding surface. Ordinarily, extra stock must be allowed on the blank because the metal must not leave the draw beads.
5. A tapered shell whose depth does not exceed one-half the diameter at the open end (Fig. 5), and is not covered by rules 1 and 2, must be drawn either into a cylindrical shape or one having a small taper in a preliminary operation.
6. Deep, tapered shells (Fig. 6) whose depth exceeds one-half the diameter at the large end, must be drawn first into stepped shells having straight cylindrical walls and then stretched to shape in a final operation.

FIG. 1 to 6 . . . In most cases, conical and tapered shells of the types shown can be made successfully by observing the proper rule

Cope Talks on Draw Dies . . . XI

Observe 6 rules when making

Drawing methods for tapered shells often differ from those for straight-walled shells, to avoid uneven metal flow and wrinkles. Besides, you must consider the effects of taper, depth in relation to diameter, and stock thickness

Two problems arise in producing tapered shells: overhang and breakage. Overhang exists also in the drawing of spherical shells, but these are usually easier to produce, because draw beads can be used. Even with the increased pressure required to pull metal over draw beads it is difficult to break a spherical shell, because the metal is distributed over a punch having a large curved area. On the other hand, the top of a conical punch is usually flat and small in diameter. Often the top and sides of the punch are joined by relatively sharp corners. Hence, this type of punch tends to shear the metal. The pulling power of the punch is considerably less than that necessary to pull the blank over draw-beads.

In drawing shallow tapered shells, the relation of stock thickness to shell diameter is often the sole factor in determining whether or not the part can be made in one operation in a regular drawing die. The thicker the stock the greater will be its resistance to formation of wrinkles. In general, the greater the angle (measured from the vertical) and the larger the shell, the greater is the need for thicker stock if regular drawing methods are to be employed.

Very often, even shallow shells must be made from a preliminary shell, either straight-walled or of a simple shape and correct size and area. The first-operation shell must provide just enough metal to permit forming the tapered shell in the final operation.

With few exceptions, all preliminary dies are exactly like those used for drawing plain round work. The various diameters and depths of preliminary shells must be carefully proportioned to prevent overstressing the metal and fractures, and to provide just enough metal—properly distributed—to permit stretching the shell to its final shape. If stretching is carried too far, or if there is surplus

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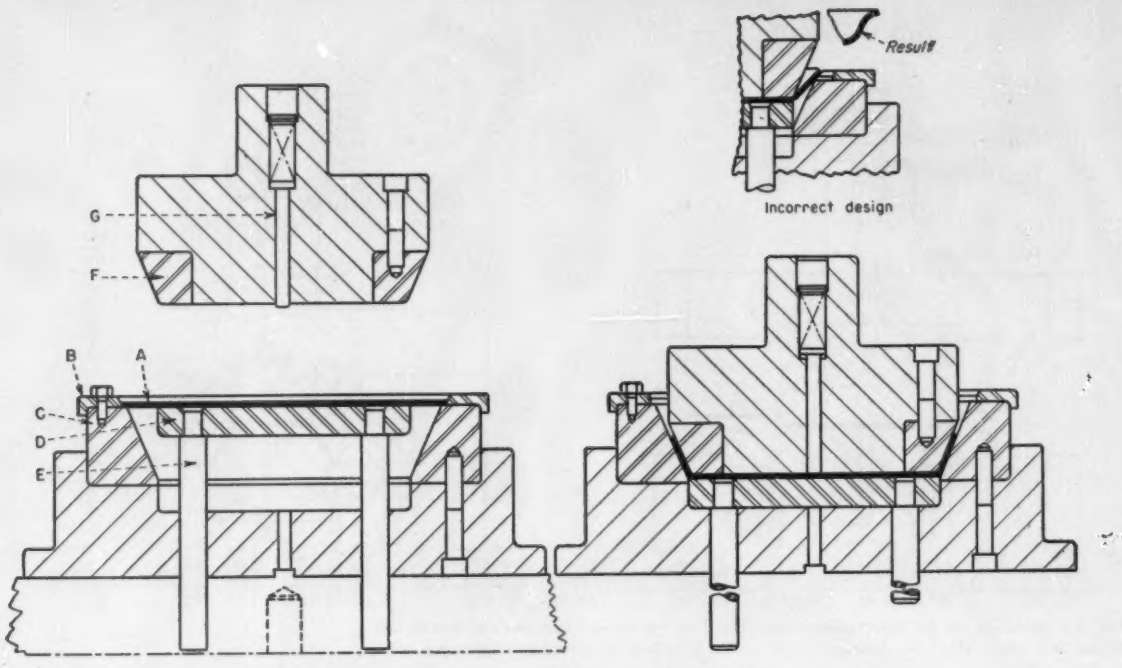

FIG. 7 . . . To draw a tapered shell (Rule 1) the die ring extends nearly to the edge of the blank, so that the shell walls are formed by a lifting action, and the metal cannot wave to gather into folds

tapered shells

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metal in the shell, trouble will be caused in the final operation. In drawing the stepped shell, heights of the various diameters are best determined by trial.

Six kinds of conical and tapered shells are shown in Figs. 1 to 6. In general, the rules given will serve, but not in all cases because it is frequently necessary to use new or special methods.

DESIGN OF TAPER DRAWING DIES

A die for drawing a tapered shell from a flat blank, without a blankholder (Rule 1) is shown in Fig. 7. The metal is thick in relation to the diameter of the shell; therefore, it will not have a tendency to wrinkle. But if the die is not designed properly, the metal will wave and gather into folds, and it will be difficult to flatten at the bottom of stroke. As a result, surface appearance of the shell may not be satisfactory, the top of the flange may be ragged, and considerably more power will be required to draw the piece.

To avoid these conditions, the metal must be kept under control at all times by allowing the die ring to extend nearly to the edge of the blank, as shown in the open view of the die. With the blank supported near the edge, the walls of the shell are formed by a lifting, or pivoting, action which does not allow the metal to wave and gather into folds. If the die ring is made only high enough to cover barely the shell, the metal will get out of control when the die is closed.

Operation of the die is: Blank *A* is placed in nest *B* and rests on die ring *C* and pressure pad *D*. Pad *D* is normally held flush with the top of ring *C* by pins *E*. When the punch descends, it grips the blank firmly against the pressure pad to hold it flat and prevent it from slipping. It then pushes the blank and pressure pad down into the die to draw the shell. The sides of the shell are struck by die ring *C* and punch ring *F* at the bottom of stroke, as shown in the closed view. Spring pin *G* is provided to prevent the shell from rising with the punch.

Because of the simplicity of this die, open punch and die holders, which have been cast from special patterns, are used. An air vent is provided in the die holder under the pressure pad.

Fig. 8 shows a combination die for blanking and drawing a tapered shell made of metal thick enough in relation to shell diameter to resist wrinkling, even though the die has considerable overhang (Rule 2). The die consists of combination blanking and drawing die *A*, blanking ring *B*, drawing punch *C*, draw ring *D*, knockout plate *E* and knockout rod *F*. Spring *G* and cap *H* are provided to hold the knockout plate up, out of the way (except when

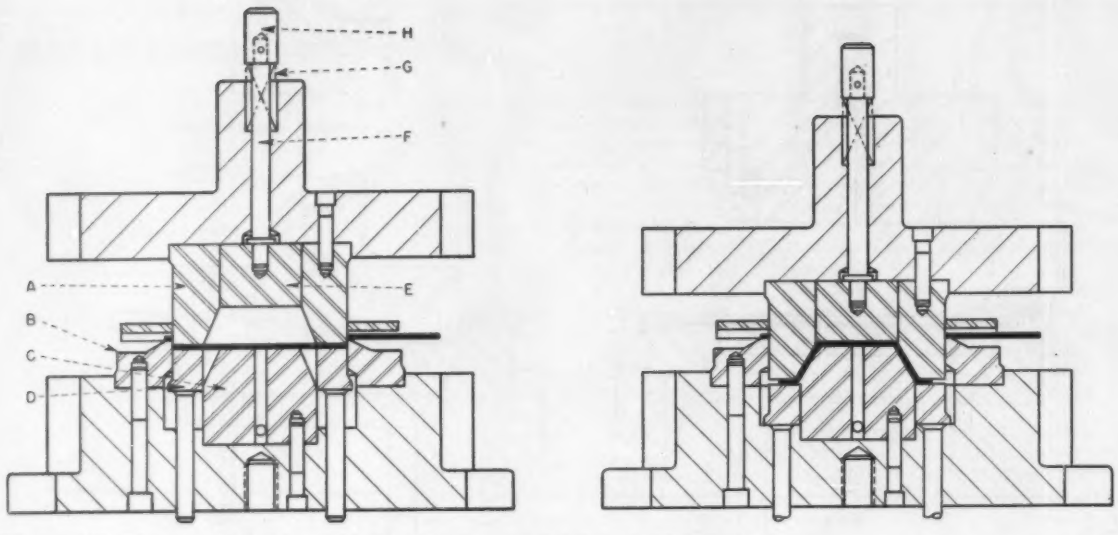

FIG. 8 . . . Although the die has overhang, Rule 2 applies: the tapered shell can be blanked and drawn in a combination die. Spring G holds up the knockout, except when ejecting the work

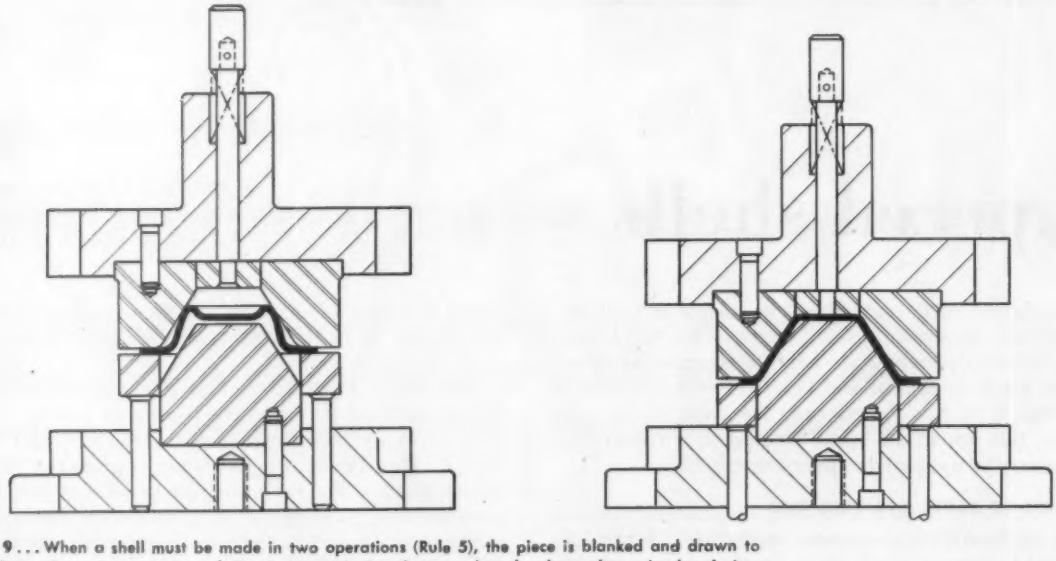

FIG. 9 . . . When a shell must be made in two operations (Rule 5), the piece is blanked and drawn to the shape shown in open view of die, then stretched and stamped to the shape shown in closed view

ejecting the work), so that its weight will not prevent the shell from rising with the die. This precaution is necessary with tapered shells because they do not stick tightly in the die. Combination blanking and drawing die *A* is arranged to strike the sides of the shell to flatten any minor waves.

The die shown in Fig. 9 is typical of those used for drawing tapered shells in two operations (Rule 5). The shell is blanked and drawn in the first operation to the shape shown in the open view of the die. It is then stretched and stamped to its final shape in the second operation. The first-operation shell is made somewhat smaller in diameter than the finished shell, and is indented at the top to provide sufficient metal to make the finished shell at right.

Areas of the first- and second-operation shells should be equal. These areas can be computed by dividing each shell into sections and then finding the area of each section by using the formulas given eariler (*AM*—Jan 4, '54, p 100). It is necessary to make the first-operation shell smaller than the finished shell in order to grip the flange in the second operation before it is stamped. This is necessary to prevent excess metal from being drawn into the body of the shell and causing wrinkles. Open and closed views of the finishing die are shown.

Part XII of Mr. Cope's series will appear in an early number.

American Machinist

SPECIAL REPORT
NUMBER 360

balanced design will . . .

fit the Chip Breaker to the job

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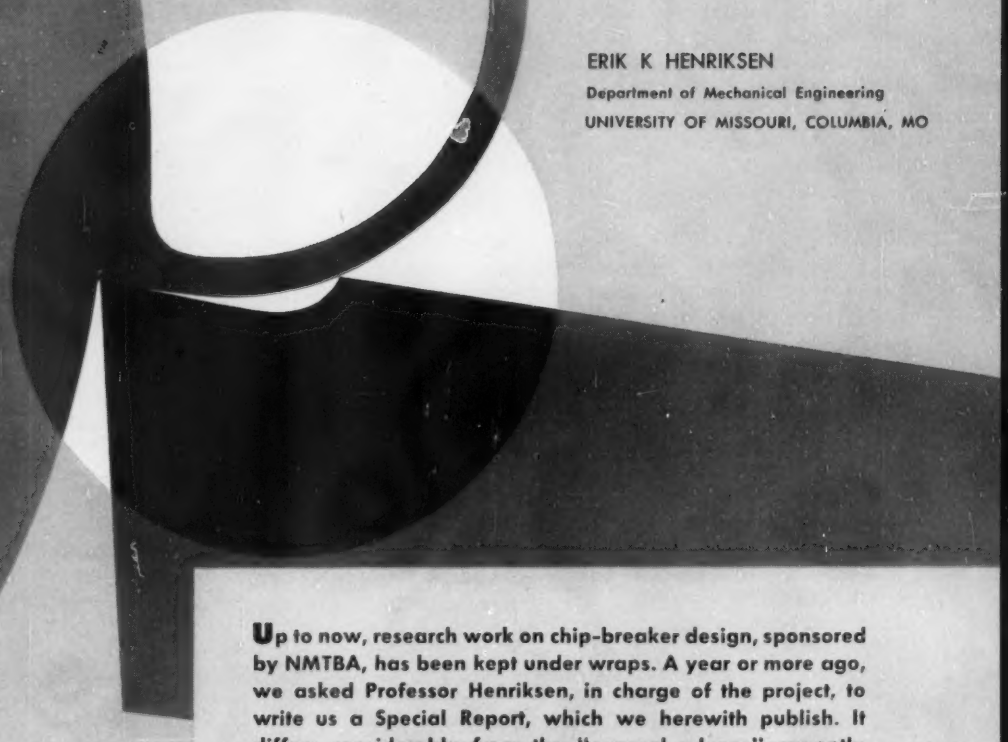

Up to now, research work on chip-breaker design, sponsored by NMTBA, has been kept under wraps. A year or more ago, we asked Professor Henriksen, in charge of the project, to write us a Special Report, which we herewith publish. It differs considerably from the "general release" currently appearing elsewhere. Our design charts have straight rather than curved lines for greater accuracy and include a new concept, that of balanced chip-breaker design

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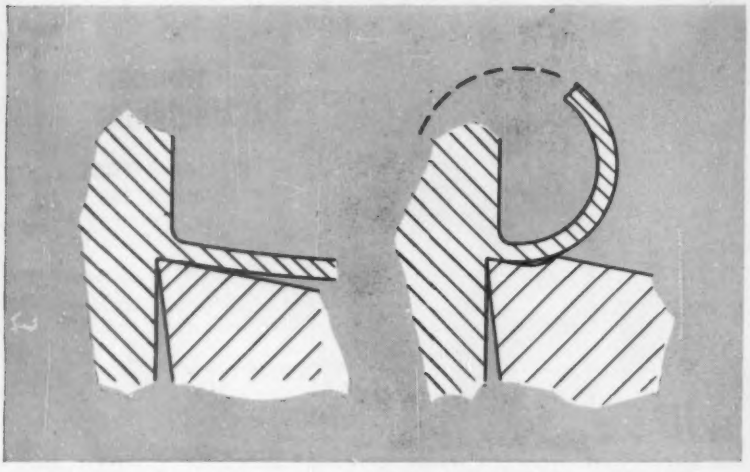


FIG. 1 . . Straight chip (plain tool) and curled chip (chip breaker tool)

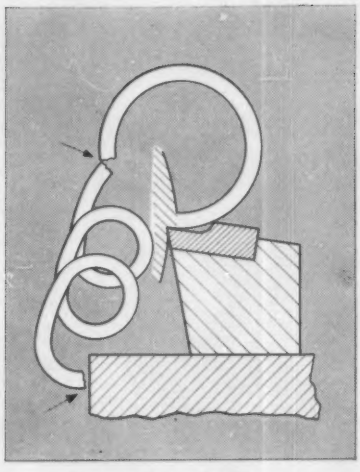


FIG. 2 . . The principal action of an ordinary chip breaker tool: The chip breaker curls the chip; the curling chip meets an obstacle (arrow); pressure builds up and the chip breaks (arrow).

Chip-breaker dimensions are critical

High-speed cutting of steel with carbide tools which have no chip breakers is troublesome for well-known reasons; but, unfortunately, it is by no means always trouble-free even if chip breakers are used, although the troubles may then sometimes take on a different character.

It is the old story of too little and too much—too little chip breaking leaves the chip in the snarling stage, just as from a plain tool with no chip breaker at all; too much chip breaking produces flying chips, which are a nuisance, if not an outright danger, to the operator, and likewise a danger to the tool itself.

Successful chip breaking requires a chip breaker of *balanced design;* that is, a chip breaker which curls and breaks the chip to the desired degree with minimum obstruction to chip flow.

To clarify the new term, "Balanced Chip-Breaker Design," the action of the chip breaker must first be analyzed. Such an analysis will reveal that the time-honored name, "chip breaker," is really a misnomer. Closer study will show that the chip breaker does not break the chip; its action is primarily that of curling or bending the chip (see Fig. 1), whereas the actual breaking is a secondary effect, which requires (a) that the flow of the curling chip meet an obstacle, and (b) that the chip have so much rigidity that a breaking pressure can build up (see Fig. 2).

The amount of curl that a chip undergoes as it passes over the chip breaker depends on chip-breaker dimensions, primarily on width w and height h. Most authorities dealing with chip breakers realize this fact to some extent and provide tables for chip-breaker width w in relation to feed, sometimes also to depth of cut.

In most cases it is recommended that width w be taken as a certain factor multiplied by the feed (with some modifications for various values of depth of cut).

The second chip-breaker dimension, height h, is usually treated rather vaguely, as is the question of any possible effect on chip breaking caused by variations in cutting speed, rake angle, properties of the work material, and the like. It is realized, however, in the existing tables that these other factors may have some effect; therefore, the common recommendation is to experiment to find the best — or perhaps just the workable—conditions.

The same situation was faced by the author in a large Copenhagen machine shop back in 1947-48; and this led to a series of experiments in the machine-tool laboratory of the Royal Technical University of Denmark, for the purpose of deter-

table 1 . . CONVERSION FROM RADIUS *B* TO WIDTH *w* AND HEIGHT *h*

(All dimensions in inches)

	Radius *B*										
	0.100	0.150	0.200	0.300	0.400	0.500	0.600	0.700	0.800	0.900	1.000
Height *h*	Width *w*										
0.015	0.053	0.065	0.076	0.094	0.108	0.121	0.133	0.144	0.154	0.164	0.173
0.020	0.060	0.075	0.087	0.108	0.125	0.140	0.154	0.166	0.178	0.188	0.199
0.025	0.066	0.083	0.097	0.120	0.139	0.156	0.171	0.185	0.198	0.211	0.222
0.030	0.071	0.090	0.105	0.131	0.152	0.171	0.187	0.203	0.217	0.230	0.243

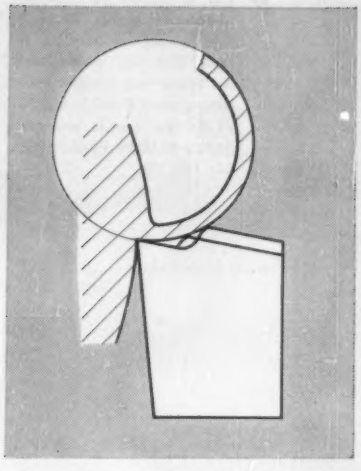


FIG. 3 . . The chip flow circle. Two chip breakers, of different widths and heights, but with the same size of the chip flow circle, will curl and break the chip in a similar manner

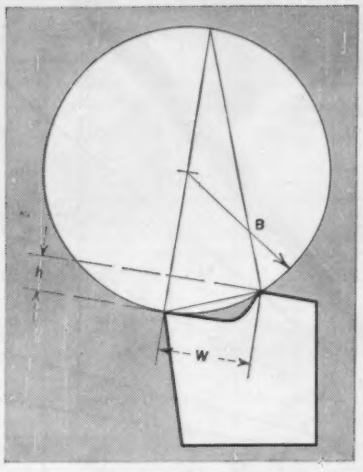


FIG. 4 . . Geometry of the chip-breaker profile, showing the relationship between width *w*, height *h*, and radius *B* in the chip-flow circle

in taming chips...

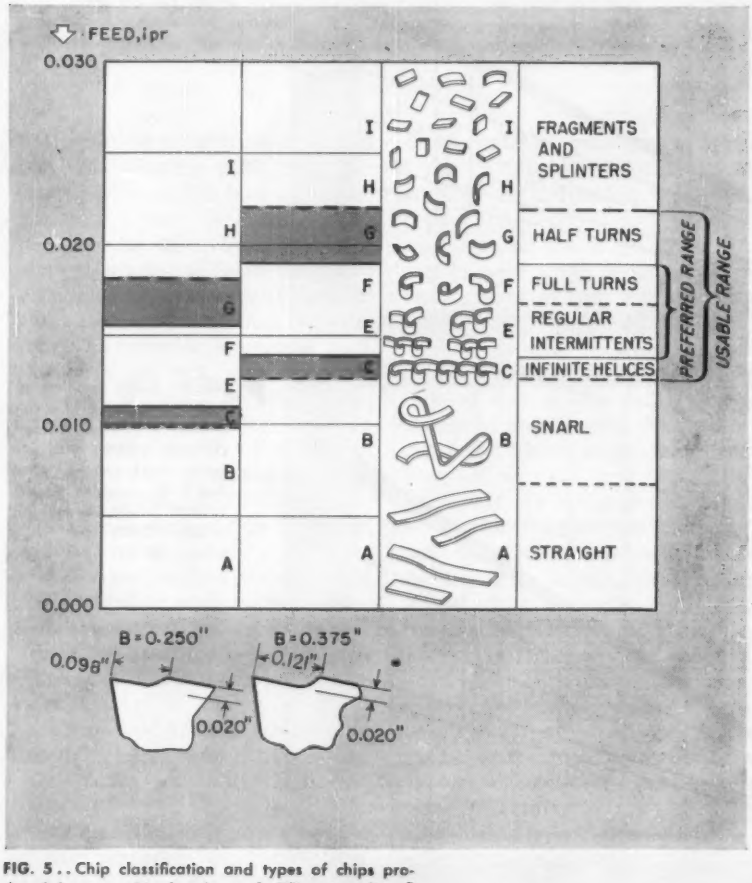


FIG. 5 . . Chip classification and types of chips produced by two chip breakers of different radius *B*

mining the effect of width *w* and height *h separately*. To begin with, the trends appeared to be quite obscure, but there was a striking similarity between the behavior of two particular chip breakers. Although of different width *w* and height *h*, these two chip breakers would always give practically identical performance; if one chip breaker would break the chip, the other would break the chip in practically the same fashion when applied under the same cutting conditions, and if one chip breaker would fail, the other would also fail.

When the two chip-breaker profiles are placed one on top of the other, Fig. 3, their significant relationship is revealed: the two chip breakers *determine the same chip-flow circle*. This fundamental observation was confirmed through subsequent tests, and establishes the general principle of chip-breaker action:

Two chip breakers, having the same size of chip-flow circle, will break the chip in (practically) *the same manner.*

The geometry of the chip breaker, and its chip-flow circle, is shown in Fig. 4. If the radius in the chip-flow circle is called *B* (for bending, because the chip breaker *bends* the chip), we have

$$B = \frac{w^2}{2h} + \frac{h}{2}$$

Corresponding values for *B*, *w* and *h* are given in Table I, and can also be taken from the diagram, Fig. 9.

Rigidity of the chip, as referred to above, is determined to some extent by its curl, but largely by its thickness, therefore by the feed. This very important relationship is clearly illustrated by this simple experiment, which can be made in any shop:

Make a cutting test on low- or medium-carbon steel at a cutting speed between 300 and 400 sfpm (to be kept as near as possible constant during the test) and with ⅛-in. depth of cut. The tool should have 0° side-cutting edge angle (no lead angle, straight turning tool) and chip-breaker dimensions should be approximately 0.125-in. width and 0.020-in. height. This

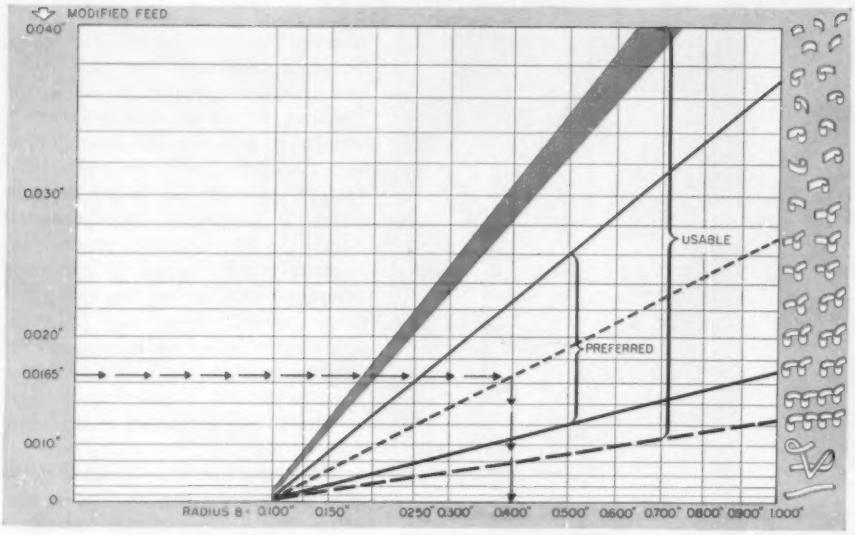


FIG. 6 . . Chart for determination of radius *B* of a chip breaker in relation to feed, showing usable and preferred feed ranges. Free-cutting steel *B* 1112, 55,000-75,000 psi tensile strength, 35,000-50,000 psi yield point, 126-150 Bhn

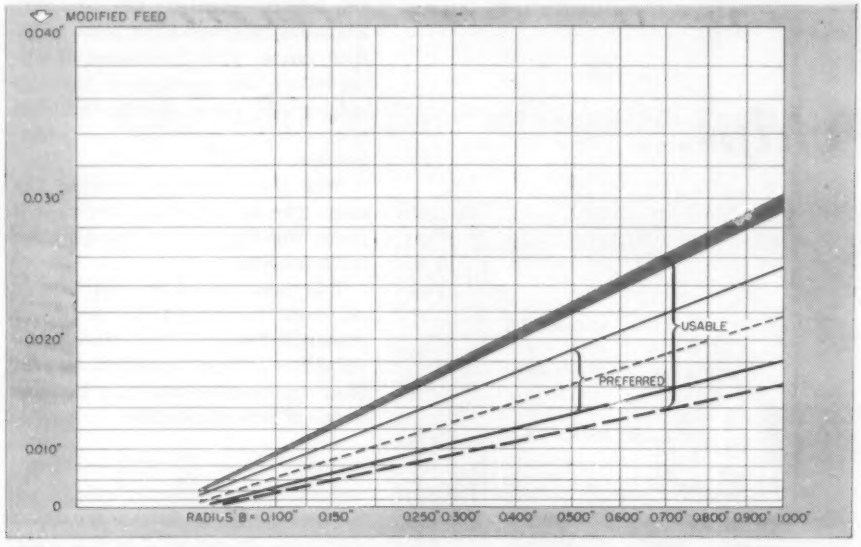


FIG 7 . . Chart for determination of radius *B* of chip breaker in relation to feed, showing usable and preferred feed ranges. Plain carbon steel C 1015, 47,000-60,000 psi tensile strength, 30,000 - 40,000 psi yield point, 101-140 Bhn

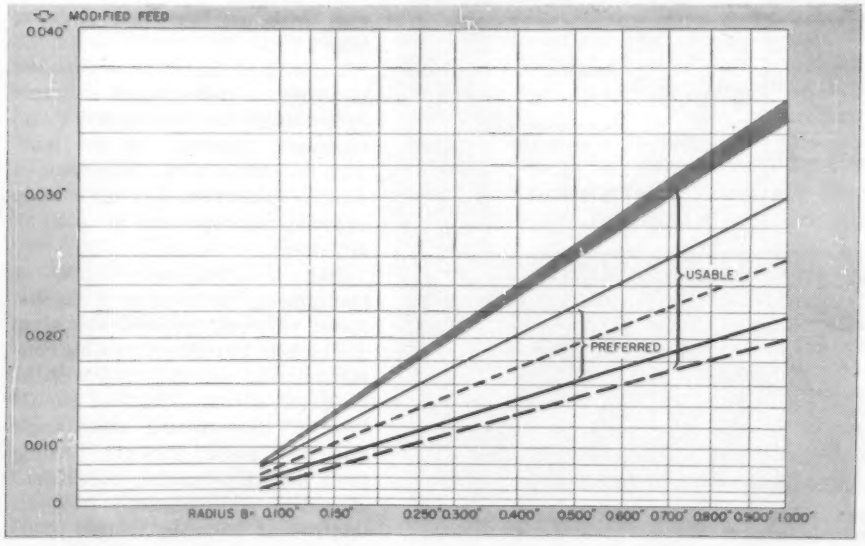


FIG. 8 . . Chart for determination of radius *B* of a chip breaker in relation to feed, showing usable and preferred feed ranges. Alloy steel 4140, annealed, 85,000-105,000 psi tensile strength, 55,000 - 75,000 psi yield point, 170-223 Bhn

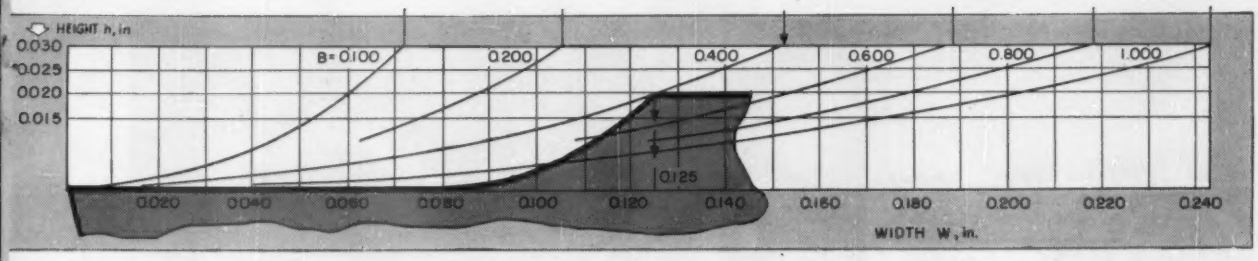


FIG. 9 . . Chart for conversion of radius *B* of chip breaker to width *w* and height *h*

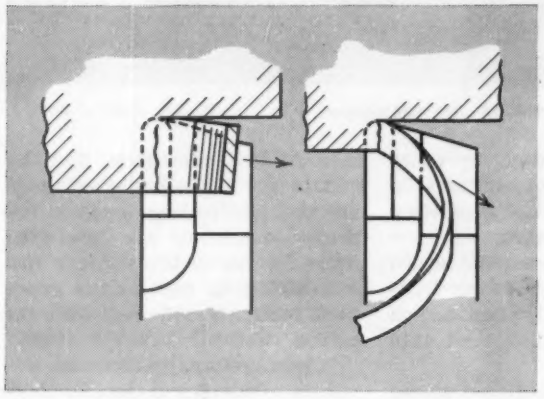


FIG. 10 . . A variation in the depth of cut changes the direction of chip flow and causes the chip to strike the chip breaker at a different angle

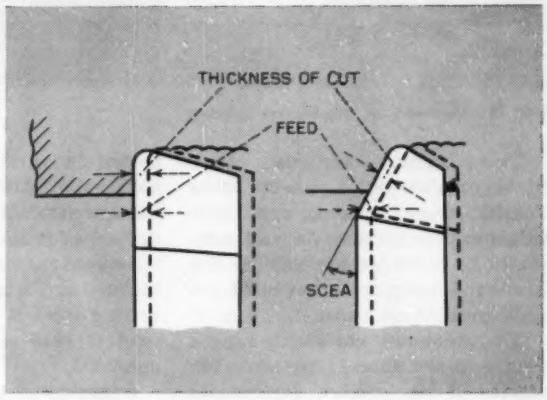


FIG. 11 . . Thickness of the cut is influenced by the side-cutting-edge angle on the tool

will result in a radius *B* of almost 0.400-in. (exactly 0.391 in.). Use a lathe with all fine feed steps; begin with a feed of 0.005-in. and increase the feed through all the steps to a value between 0.025 and 0.030 in. Collect typical samples of chips from each feed step, and arrange in order of increasing feed.

Such a test will give a picture like that in Fig. 5, in which chips from tests with two chip breakers of different radii *B* are shown in relation to the corresponding feeds. This illustrates, in a nutshell, the whole basic story of chip breaking, which is:

a. The radius *B* in the chip-flow circle, together with the feed, controls the degree of chip breaking.

b. Chip breaking is increased at increasing feeds and decreasing radii *B*.

c. *Any* type of chip can be produced by *any* chip breaker, but only within a limited range of feeds.

In Fig. 5 is also shown a system of chip classification, and it now remains to select the "satisfactory" or "acceptable" chip type or types. This, however, depends upon whether we are dealing with high-production conditions or with short-run or single jobs.

High production requires special tooling anyhow, and it is therefore economical to design each tool, including its chip breaker, for one purpose only. The most desirable type of chip is the one which is easiest to handle (the "shoveling" chip) and which, at the same time, does not sacrifice tool life. These conditions are simultaneously fulfilled by the "regular intermittents" and the "full turns" (including three-quarter turns). Feed ranges within which these two chip types are produced constitute, therefore, the "preferred range" of feeds. A middle line through the preferred range is the bull's-eye at which the design should be aimed. This is the middle-of-the-road course, where maximum safety is provided in either direction, to take care of unavoidable irregularities in properties of the material, quality and accuracy in chip-breaker grinding, condition of the cutting edge, and so on.

Production conditions in the job shop require versatile equipment in general, and therefore tools of a general-purpose character. In terms of chip breakers, it means the widest possible range of feeds, consistent with a tool life which is still acceptable, although shorter than required for high-production tools. For general-purpose tools we can, therefore, include the "infinite helix"; this is a chip type which is well under control and can be conveniently guided into the chip pan of the machine. We can also include a certain amount of half turns ("half moons"); as long as they appear in mixture with larger chips they are not too hard on the tool and can be accepted for short-run jobs. But when half turns appear in large quantity, and particularly when they gradually change to fragments and splinters, we have "over-breaking" of the chips and the tool is exposed to a heavy, vibrating load which very soon will have damaging effects.

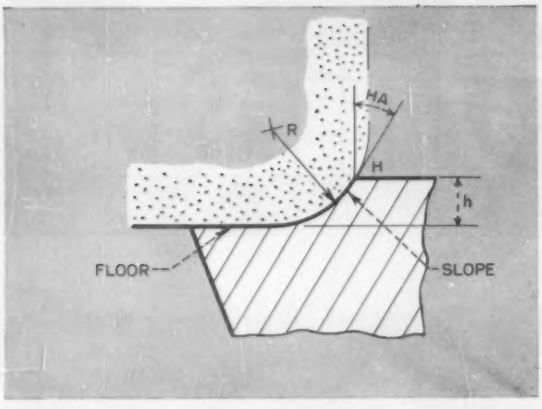


FIG. 13 . . Geometry of chip-breaker grinding

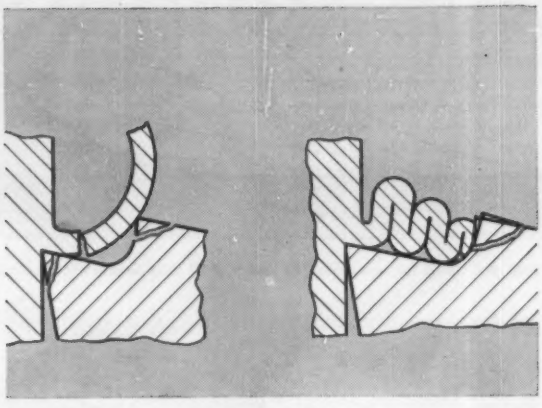


FIG. 14 . . The tool breaker . . .

This expansion of the range of acceptable chips results in a "usable range" of feeds, applicable to general-purpose tools, and normally up to twice as large as the preferred range recommended for high-production tools.

The preferred and usable ranges of feeds for three representative grades of steels were determined through the author's almost year-long research project at Cornell University, generously sponsored by the National Machine Tool Builders' Association and supported in various ways by other sections of American industry in the common interest of promoting the art of metal cutting.

Some of the results are condensed in Figs. 6, 7 and 8, covering free-cutting steel B 1112, plain carbon steel C 1015 and alloy steel 4140 annealed.

A glance at these graphs shows clearly the very wide variation in the response to chip breaking for the three steels. The preferred and usable ranges are up to 2½ times larger for the free-cutting steel than for the alloy steel, and the middle line in the *preferred* range for the free-cutting steel is entirely *outside* of the preferred range for the carbon steel; in fact it is almost as high as the upper limit for the *usable* range for the carbon steel.

It is, therefore, by no means advisable to attempt to transfer chip-breaker data indiscriminately from one material to another without careful investigation, and it is virtually impossible to formulate reliable chip-breaker rules covering a variety of materials. Each material, or group of related materials, must be treated separately.

A chip breaker that works fine on one material may utterly fail when used for a different material, even if feed and other cutting conditions are identically the same.

In addition to these important observations, the graphs provide the answers to these questions:

(a) Which types of chips can be expected with a given chip breaker and a certain feed?

(b) At what feed should a given chip breaker be used when a certain type of chip is desired?

(c) What size of radius *B* in the chip breaker is necessary at a given feed when a certain type of chip is desired?

Primarily the graphs determine radius *B*, but in conjunction with Fig. 9 their use can be extended to a direct reading of the corresponding values of width *w* and height *h* of the chip breaker.

Effects of the various cutting conditions and tool shapes, such as cutting speed, depth of cut, and

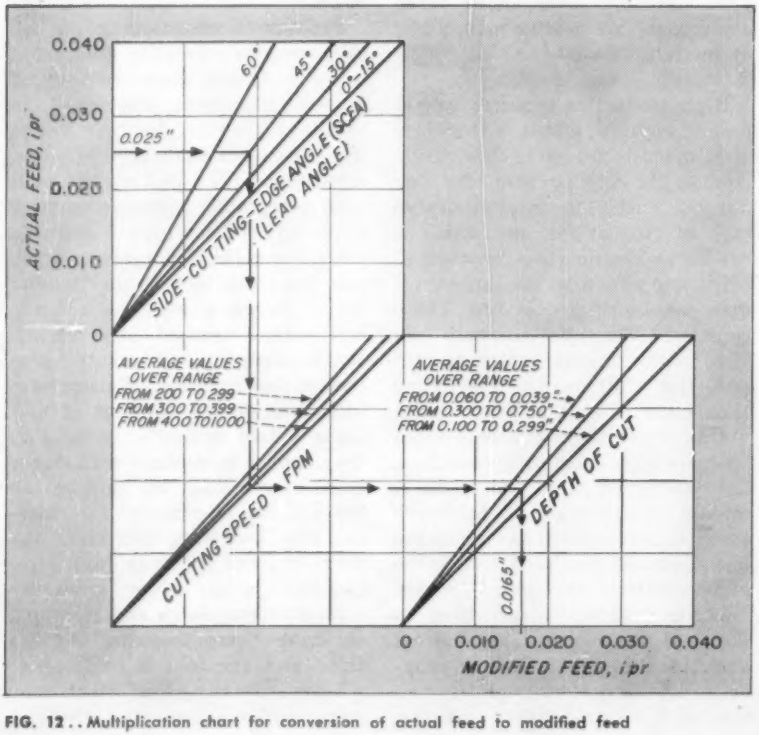
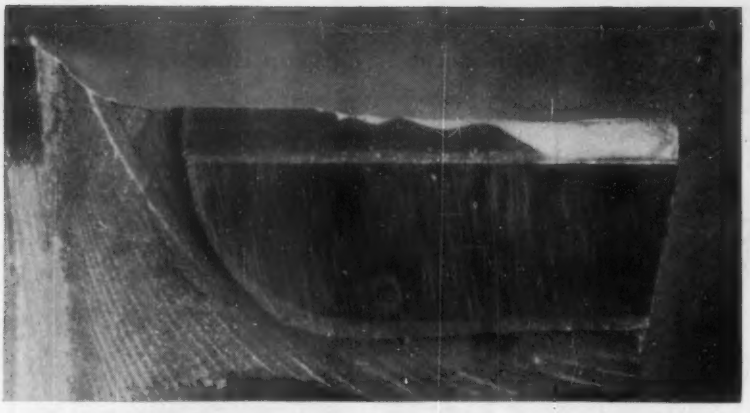


FIG. 12 . . Multiplication chart for conversion of actual feed to modified feed



. . . and its results, FIG. 15

table 2 . . LOWER AND UPPER LIMITS FOR CORNER RADIUS R ON GRINDING WHEEL

Chip Breaker Height h, In.	R_{min} to R_{max} In.
0.015	0.035 to 0.065
0.020	0.050 to 0.085
0.025	0.060 to 0.100
0.030	0.070 to 0.125

side-cutting-edge angle, can all be deduced from their effect on the thickness of the chip and the radius of the chip-flow circle. An increase in cutting speed tends to decrease chip thickness (besides it makes the chip more elastic, perhaps through metallurgical changes), a decrease in the depth of cut will change the direction of the chip flow and make the chip strike the chip breaker at a different angle, thereby increasing the effective radius in the chip-flow circle (Fig. 10), an increase in the side-cutting-edge angle will decrease the chip thickness (Fig. 11).

All these variations can be covered at the same time by using the graphs in Figs. 6, 7 and 8 with a "modified feed" instead of the real feed. The modified feed can be taken from Fig. 12 for a large variety of cutting conditions. Use of the graphs will be explained in a practical example.

Having now provided the means for designing the chip breaker for the correct degree of chip breaking, we shall direct our attention to the second factor in the balanced design, the chip flow with a minimum of obstruction.

This phase of chip-breaker design is intimately connected with the slope of the chip breaker and the size of heel angle *HA* (see Fig. 13). The function of the slope is to lift the chip from the floor of the chip breaker, carry it over the heel, and give it the permanent curl, all in a gentle and soft sweep. This is best accomplished when heel angle *HA* has a value between 35° and 50°. As the slope is formed as a fillet with radius *R* (not the same as radis *B*, but equal to the radius on the corner of the grinding wheel) this provides an equation for determination of *R*. The equation is

$$\sin HA = 1 - \frac{h}{R}$$

from which Table 2 is computed.

Direct practical conclusion to be drawn from this geometrical relationship is that the corner radius on the grinding wheel should be kept under control (check it regularly with a radius gage) and maintained within a lower and an upper limit. Periodic truing of the diamond wheel should be confined to the straightening of the wheel face and reduction of the corner radius to the lower limits given in Table 2. When regularly applied, this practice will result in a great saving in diamond, up to 50%, sometimes even more, as compared to the common, and very wasteful, truing of the wheel straight up to the corner.

Truing of the wheel to a sharp corner is also dangerous to the tool itself. With a more or less vertical-wall at the back of the chip breaker, the gentle lifting effect of the slope is lost, the chip flow is interrupted, the chip breaker gets crowded (Fig. 14) and the tool point, or chip breaker, or both, are sheared off, all in less time than it takes to describe it.

This poor practice of truing the wheel to a sharp corner is much more widespread than one would expect. *It is probably responsible for more tools damaged or destroyed than any other error in tool grinding.* Nevertheless, it is described in technical literature, and it is practiced in the most modern and (otherwise) efficient shops. But whether it is done intentionally or unintentionally, the result is always the same (see Fig. 15): The chip breaker becomes a tool breaker.

PRACTICAL EXAMPLE

Given a free-cutting steel; to find chip-breaker dimensions for the tool.

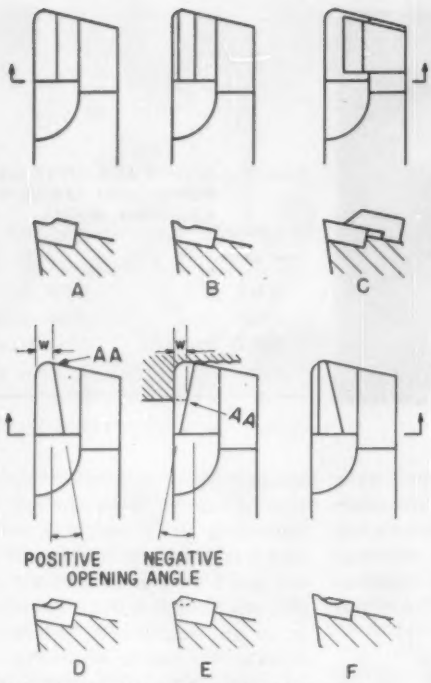
Feed: 0.025-in. per revolution
Side-cutting-edge angle: 45°
Cutting speed: 500 sfpm
Depth of cut: 5/16 in. = 0.3125 in.
Solution:

Use graph in Fig. 12. Start at 0.025 ipr actual feed, go to the right, meet line for 45° SCEA, go down, meet line for 400-1000 sfpm cutting speed, go to the right, meet line for 0.300-0.750 in. depth of cut, go down, read 0.0165 ipr modified feed.

Use graph in Fig. 6 for free-cutting steel. Start at 0.0165 ipr modified feed, go to the right, meet middle line, go down, read 0.400 in. radius *B*.

Use graph in Fig. 9. Choose a chip-breaker height *h*, say 0.020 in. Start at $B = 0.400$ in., follow circle, meet line for 0.020 in. height, go down, read chip-breaker width $w = 0.125$ in.

Use Table No. 2. A chip-breaker height of 0.020 in. requires a corner radius *R* on the grinding wheel not less than 0.050 in. and not more than 0.085 in.



ALL CONVENTIONAL TYPES OF CHIP BREAKERS CAN BE CLASSIFIED AS FOLLOWS:

A . . Ground Chip Breakers—The chip breaker is ground into the body of the tool.

B . . Clamped Chip Breakers—The chip breaker is formed by a beveled block clamped on the face of the tool. (These are sometimes called mechanical chip breakers—an unfortunate terminology because there are devices which, more or less successfully, employ a mechanical motion for breaking the chips.)

Each of these types can be further classified as:

1 . . Parallel Chip Breakers—The heel of the chip breaker is parallel to the cutting edge of the tool.

2 . . Angular Chip Breakers—The heel forms an angle with the cutting edge.

The various combinations in general use are shown here. When properly applied, the rules, charts, and data previously mentioned can be used for all types of chip breakers.

Fig. 16 . . TYPES OF CHIP BREAKERS
(A) Ground parallel—step type
(B) Ground parallel—groove type
(C) Clamped parallel—step type
(D & E) Ground angular—step type
(F) Ground angular—groove type

ACKNOWLEDGEMENTS

The author wishes to express his sincere thanks to the following for their generous support to his experimental work on chip breakers: National Machine Tool Builders' Association (financial support), Lodge & Shipley Company (lathe), Kennametal Inc, Wesson Company, Viking Tool Company, A S Batco (carbide tools), D A Stuart Oil Company (cutting oil), The Danish Steel Rolling Mill (work material).

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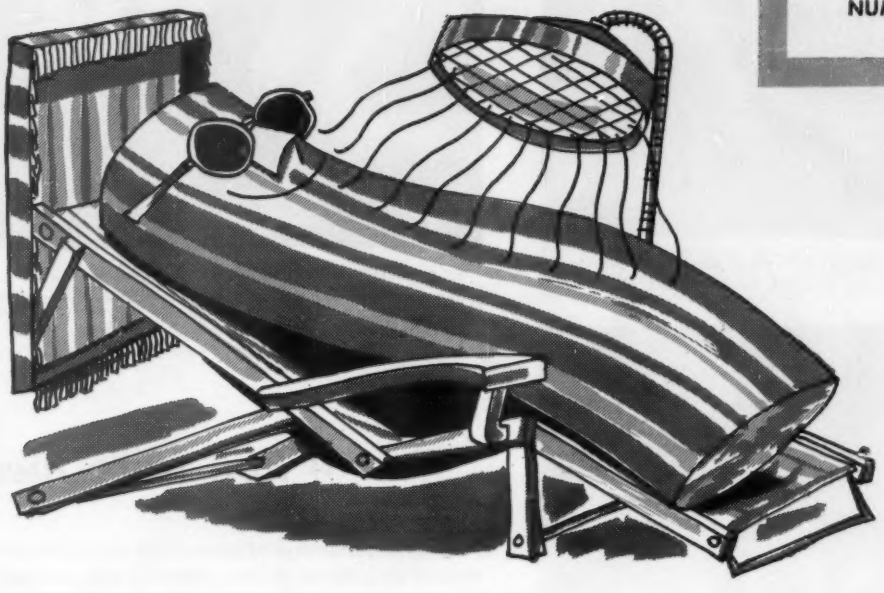
American Machinist
SPECIAL REPORT
NUMBER 361



How to understand

Heat-treatment processes

SAMUEL STORCHHEIM, metallurgical engineer

What happens to a metal when it is heated and cooled? What can heat-treatment accomplish? How important is temperature control? What can result from improper atmosphere? Can closer metallurgical control save money? Why is cooling rate important? These, and a thousand-and-one other questions are asked daily in shops all over the country. Here, in the simplified terminology of previous reports by the same author, are some of the answers . . .

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FIG. 1 . . **STRUCTURE** of ductile, soft nickel wire shows narrowness of grain boundaries for this material, which is readily bent. 250x

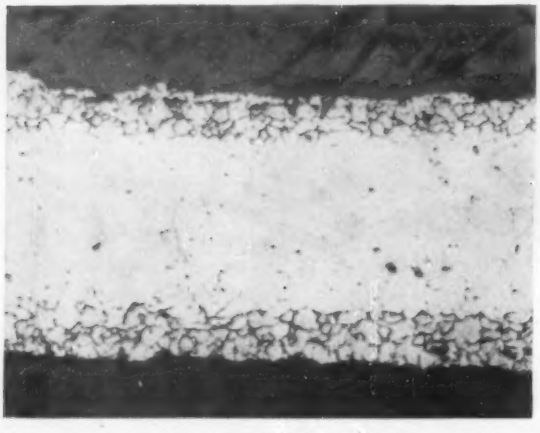


FIG. 2 . . **SMALL QUANTITY OF SULFUR** in atmosphere, while heat-treating, forms nickel sulfide around the grain boundaries near the surface; creates the embrittlement shown. Prolonged exposure to sulfur-bearing atmosphere while heated would cause complete envelopment of all grains of nickel. While latter condition would greatly weaken structure, specimen shown still retains considerable ductility. 250x

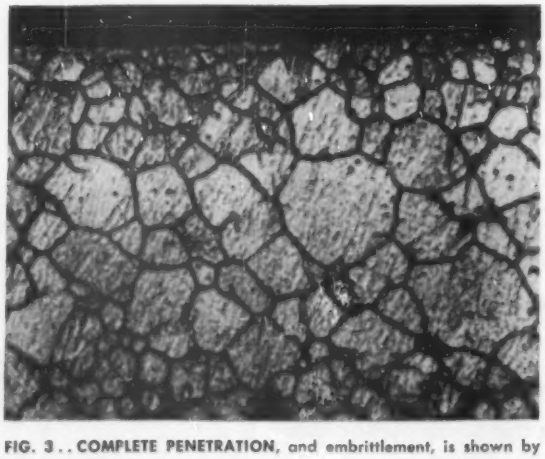


FIG. 3 . . **COMPLETE PENETRATION**, and embrittlement, is shown by the heavy, black lines surrounding each grain. Ductility is destroyed. 250x

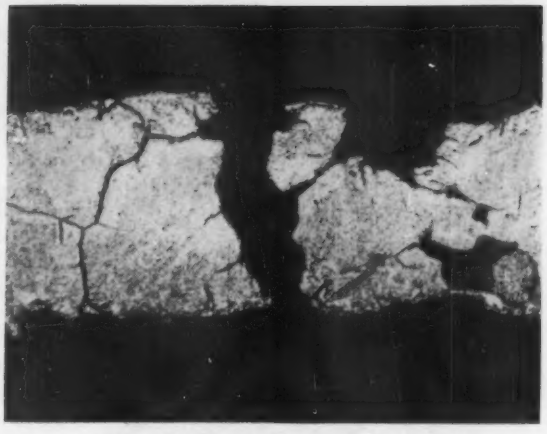


FIG. 4 . . **INTERCRYSTALLINE BREAK** in embrittled nickel specimen shows cleavage along grain-boundary lines. Proper atmosphere control might have prevented this condition. 100x

When pure metal

Actual solidification of the molten metal, or the *melt*, occurs by several related steps. Here is what happens:

Molten metal consists of atoms which are not perfectly arranged but are in a random, continuously moving, mass. There is no clear-cut geometric pattern to their relationship. As the temperature of the melt decreases, the movement of these atoms decreases. At some times tiny groups cluster together as "embryos" in definite geometric relationships. These embryos, however, break-up and again become part of the entire atom mass. Continued temperature decrease causes more of these embryos to form. Now, at a specific temperature for each pure metal, the embryos attract other atoms which, in turn, join the new, specific, geometric alignment. These bigger atom clusters, or tiny crystals, are now called "nuclei" and they no longer break-up and dissolve away but, rather, begin to attract still more atoms which fit the new geometric pattern or *crystal structure*. Soon there are nuclei in many parts of the melt and they are all growing.

Each growing nuclei is called a "grain". Naturally, all of these little growing crystals or grains are mixed helter-skelter in the molten metal and therefore are not aligned, *oriented*, in the same directions. Eventually they bump into each other and stop growing—all of the molten metal has solidified.

The meeting places, interfaces, of the grains are called *grain boundaries* and represent areas of "misfit"—locations where the geometric continuity of the atoms of one grain do not continue on perfectly into the next. Thus, these areas are *upset* and are locations of higher *free energy* than the interior of a grain. Thus, if any activity takes place

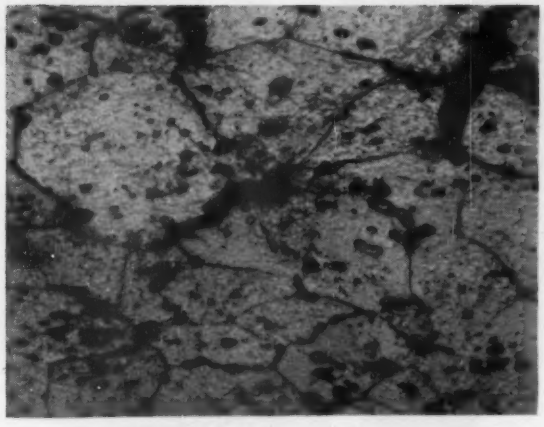


FIG. 5 . . EFFECT OF SWAGING a 50% molybdenum-50% tungsten alloy which resulted in intercrystalline fracture shown. Grains are very large with porosity along the grain boundaries running into cracks. Grains are elongated in direction of swaging. Proper heat-treatment can reduce and refine grain size to minimize danger of fracture. 250x

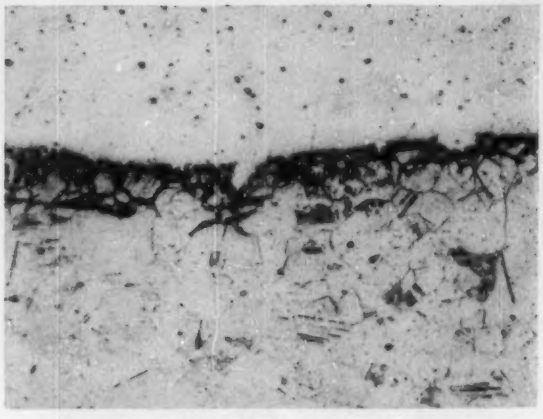


FIG. 6 . . BONDING is the interlocking of metallic grains by soldering or brazing. Here, Kovar is soldered with pure silver, which can be seen to have penetrated the Kovar to a considerable extent. Many grains are outlined by the silver. Kovar, lower half of picture, is nickel-iron alloy with expansion characteristics similar to glass. 250x

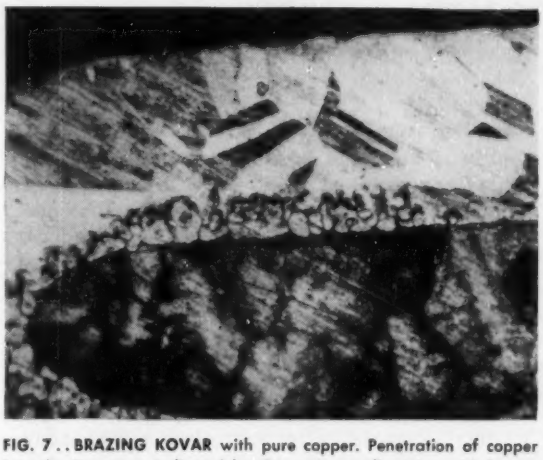


FIG. 7 . . BRAZING KOVAR with pure copper. Penetration of copper into the Kovar, as indicated by the many small grains with heavy, dark, boundaries, is readily seen. Copper is dark material. Bonding (brazing, soldering) is a mechanical interlocking, therefore it differs from fusion (welding), which is a continuous crystalline joint between two pieces of the same metal. 250x

solidifies...

in the metal during subsequent heat-treatment or deformation, the likelihood of it occurring first at the higher free energy areas, *grain boundaries,* is greater. Also, energy present at the grain boundaries will act as the sportsman's "handicap".

Perhaps arbitrary number designations will clear this point. Call the grain interiors "2" and the boundaries "6". Let us say that a certain phenomenon, perhaps precipitation hardening, will occur when the value of either is 10. Then, let us assume that by raising the temperature of the metal 100 F, the numbers of the grain interiors and boundaries will increase by a value of 2. Therefore, at 100 F the grain interiors will be $2 + 2 = 4$, and the boundaries, $6 + 2 = 8$. At 200 F, the grain interiors will be $4 + 2 = 6$, and the boundaries $8 + 2 = 10$. *Immediately the reaction (phenomenon which will occur) begins at the grain boundaries for they have reached the required energy value.* The frain interiors would, by our example, require an additional increase of temperature to 400 F before the reaction would occur.

Because the grain boundaries are of higher free energy than the grain interiors, a number of conditions arise which can be detrimental. For instance, corrosion of certain types (*AM*—Dec 21, '53, p 113) will occur along the grain boundaries and destroy the usefulness of the metal. An example is the aluminum-copper known as duraluminum. If this alloy were not protected by being clad with pure aluminum, eventually it might fail as corrosion follows the grain boundaries.

Another example is the embrittling action of sulfur on nickel. If nickel is heat-treated in an atmosphere containing even slight amounts of sulfur, the sulfur rapidly attacks the metal along the grain boundaries. The product formed is black nickel sulfide which destroys the ductility of the nickel, (Fig. 1, 2, and 3).

It is usually desirable to have a metal in such a condition that in order to fail mechanically, *rupture,* in service, the failure must occur through the grains, *transcrystalline,* rather than along the grain boundaries, then the required force to rupture the metal is less than the force required for failure through the grains. This occurs because the grain boundaries offer high free-energy "paths" that are interconnected right through the metal.

When an undesirable constituent having a low melting point is in the metal, this material will solidify last. From the above discussion we see that the grains build-up from the center and the last part to

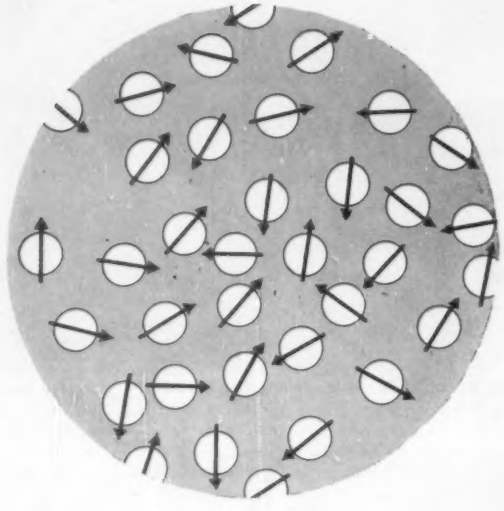


FIG. 8 . . ATOMS OF MOLTEN METAL are constantly in motion and are randomly arranged. Temperature of molten metal is well above freezing point. No structural pattern exists

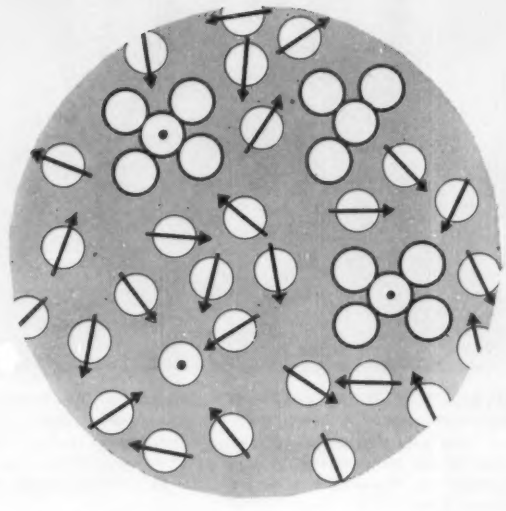


FIG. 9 . . AS TEMPERATURE IS LOWERED, embryonic crystals are momentarily formed and then broken up. Arrangement is still random wtih no definite pattern. Temperature is near freezing point

solidify is the grain boundary. Therefore, the undesirable constituent of low-melting point would freeze (last) at the grain boundaries. Subsequent heating would cause this material to melt at the boundaries, the metal grains would not be held together, and failure would occur if the metal were deformed at this temperature. This condition of the metal is termed *hot shortness*. As little as 0.006% of bismuth in copper will cause the copper to lose all of its ductility. Only 0.04% lead in brass containing less than 38% Zn will cause the brass to be hot short. If excess sulfur forms iron sulfide at grain boundaries in steel, the steel will be hot short and is subject to failure during hot deformation.

In addition, grain boundaries also offer easy paths of access for the rapid migration of atoms or movement, *diffusion*, of atoms of another metal or alloy into the parent metal. In fact, the rate of diffusion along grain boundaries is about 100 times more rapid than through the grains themselves. Thus it is possible to *bond* two different metals more rapidly because one of the metals moves along the grain boundaries quickly and interlocks itself to the parent metal. Bonding through the grains would of course take a longer time. Certain soldering and brazing operations, as well as cladding operations, function in the former way. (Fig. 6 and 7.)

Pure metals such as iron, copper, and aluminum, will suddenly start to solidify at *one particular temperature* as the temperature of the molten mass is decreased. Also, the process will occur such that this solidification temperature will remain constant until the entire molten mass has become solid. Once this has happened, the temperature of the now solidified metal will continue to decrease. The temperature of solidification is termed a *critical point* in the curve.

The constant temperature results during solidification because the molten metal, while freezing, is giving up heat. The heat is called the *Latent Heat of Fusion*. (Conversely, if this solidified mass were to be reheated, the metal would suddenly melt at the same temperature, the melting point, it originally solidified at, and the temperature of melting would be constant for a period of time.) Once this constant temperature period of time has elapsed, the temperature of the molten mass is readily shown by the cooling (or heating) curves. They are obtained by placing a thermocouple in the molten bath and, as it cools, noting the time and corresponding temperature (Fig. 12). When molten iron is cooled to room temperature, a total of four definite periods of constant temperature occur (Fig. 12, d). However, the length of time at each of the last three temperatures will be considerably less than the time when the molten iron solidified.

These temperature-drop pauses are associated with the atomic structure of the iron. At the various constant temperature points, the iron atoms rearrange themselves into different geometric relationships. The last constant temperature point is associated with the iron becoming magnetic and is termed the Curie point. (*AM*—Mar 30, '53, p 111-118) The atomic rearrangements are called *allotropic changes*, or *transformations*, and the temperatures where these rearrangements occur are referred to as *critical points* or *critical temperatures*.

Varying the speed of cooling tends to cause the critical temperature to change. Very rapid cooling generally lowers the freezing point and this is commonly referred to as *supercooling*.

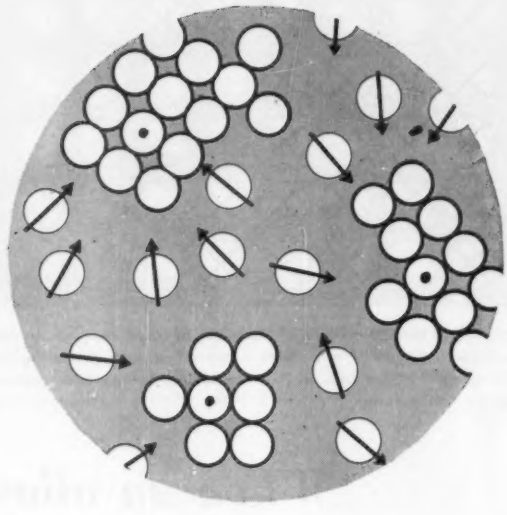


FIG. 10 . . FURTHER COOLING permits embryos to stabilize and form the nuclei for crystal growth. Mass attraction causes the randomly moving atoms near the nuclei to move toward them; finally attach themselves in orderly arrangement

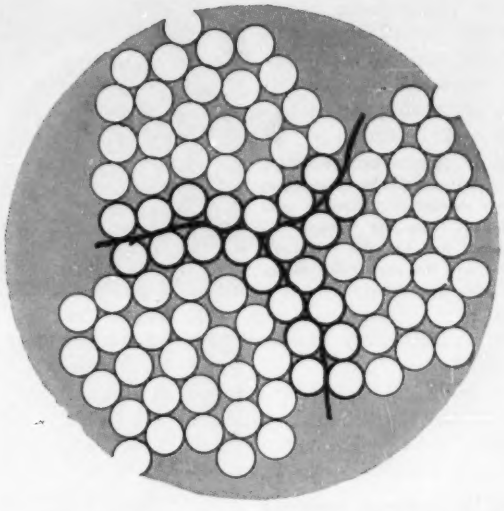
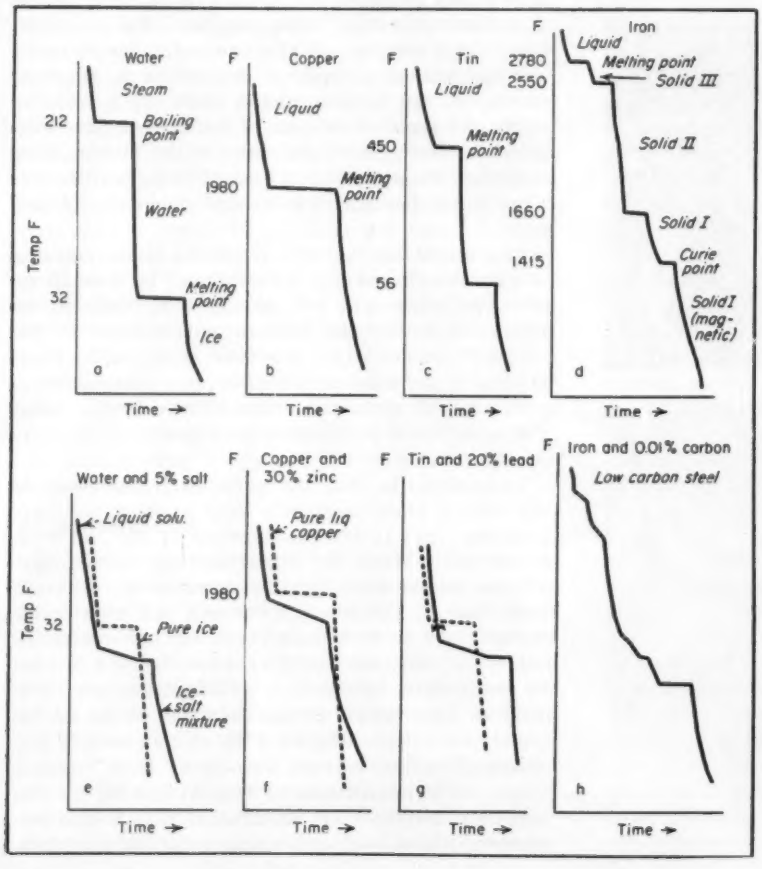


FIG. 11 . . AS SOLIDIFICATION CONTINUES at still lower temperatures, nuclei have grown to a size where the individual grains or crystals "bump" each other; thus inhibit further growth. Outlined atoms of each grain do not line-up with atoms of other two grains. Meeting places of these atoms are called grain boundaries. Metal is now solid



PURE SUBSTANCES

SOLUTIONS AND ALLOYS

FIG. 12 . . COOLING CURVES

TEMPERATURE VS TIME RECORD of a substance going through a condensation, solidification, or other physical transformation, as heat is removed in some slow and regular manner (cooling in air) is called a cooling curve. If the substance is not pure (water and salt or an alloy such as copper-zinc), then the cooling curve is modified. Each stage or condition is called a ***phase***

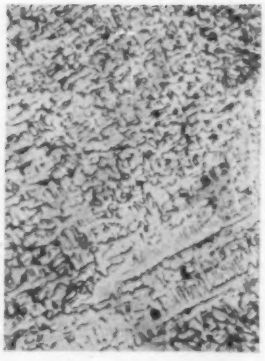


FIG. 13 . . DENDRITIC STRUCTURE of copper-nickel *alloy* (50x) shows small dendrites, the *alpha* solid solution. Note the marked imbalance between the nickel-rich cores and the copper-rich filling, or grain boundaries

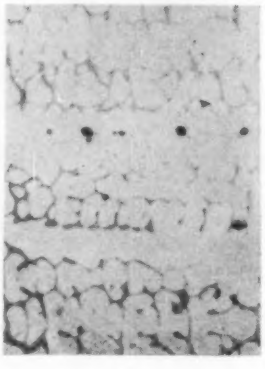


FIG. 14 . . DENDRITIC STRUCTURE of *pure metallic copper* (50x) shows more regular dendrite pattern formed as metal solidifies from liquid state. Only 0.03% oxygen is present as cuprous oxide but it forms, with copper, the dark structure outlining the dendritic cells

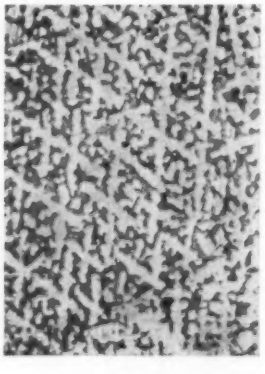


FIG. 16 . . CUPRO-NICKEL dendritic structure (50x) as chill cast and heated 3 hr at 750 C shows only slight improvement of cored structure

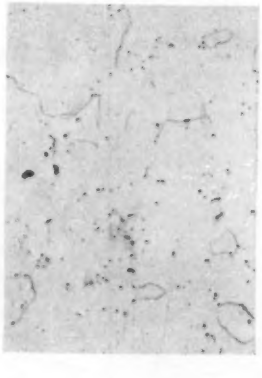


FIG. 17 . . CUPRO-NICKEL SOLUTION ANNEALED (homogenized) structure after heating 9 hr at 950 C (50x). Note that the composition has equalized at all points. Black particles are copper oxide or nickel oxide inclusions

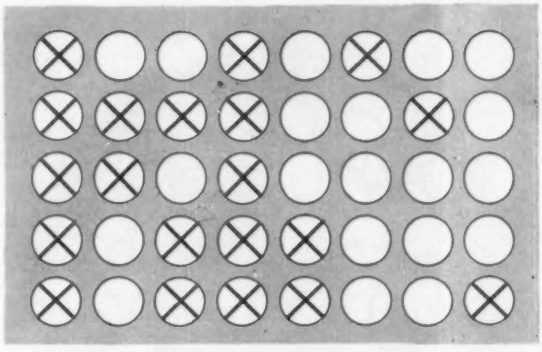


FIG. 15A . . BEFORE HOMOGENIZATION, a cored alloy shows uneven concentration of one metal in the other, as indicated by the arrangement of dissimilar circles. Mechanical and chemical properties are non-uniform

When an alloy

When pure metals are alloyed, mixed with other metals, their solidification from the molten state is similar to that of pure metals. There is the embrionic state, followed by nucleation, in turn followed by growth. However, although alloy solidification follows a path that is about the same as for pure metals, a number of unique things happens. For example, most alloys solidify not at a particular temperature, but rather over a range of temperatures. In other words, as the melt is cooled some solid particles (crystals) start to come out of the mass. As the temperature drops, more and more of the molten alloy solidifies. Thus, there is a "slushy" stage where the alloy is neither completely molten nor completely solid.

One might say that this is similar to the freezing of pure metals and this would almost be true. However, the alloy will not solidify completely if the temperature is held constant somewhere in the "slushy"" stage, while the pure metal will. Thus, holding a partially-molten alloy at a constant temperature will cause no change to occur while doing the same for a pure metal will permit it to completely solidify.

In addition to this, the particles freezing-out of the molten *alloy* constantly vary in chemical composition, right to the solidification of the last drop of the alloy. Thus the initial crystals freezing out at one temperature have a composition different from that of the crystals freezing out at a lower temperature. In some cases the first crystals solidifying out of the melt are almost exactly the reverse in composition to the last bit of molten metal to solidify. An example of this condition would be the aluminum-silicon alloy of 95% aluminum and 5% silicon. The first crystals solidify at 1130 F into a single phase, *constituent*, of 99% Al and 1% Si. The last bit of molten alloy solidifies at 1075 F into two phases: About 90% is a single constituent of 98%

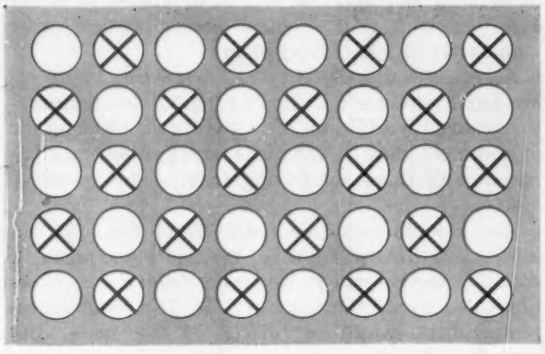


FIG. 15B . . CORRECT SOLUTION ANNEALING causes the atomic arrangement to change, hence concentration gradients are evened out to form balanced distribution. Uniformity of mechanical and chemical properties is greatly improved

solidifies . . .

Al and 2% Si, while the other 10% is a second constituent of 1.5% Al and 98.5% Si.

CORED DENDRITIC STRUCTURE

This non-uniformity of chemical composition of the solidified alloy mass is called coring and in many instances it is observed under the microscope to be *dendritic*. The pattern of the dendritic structure is tree or fernlike in appearance—it has many branches (Fig. 13). Excellent illustrations of dendritic structures are the familiar frost patterns seen on windows.

Pure metals can also solidify as dendrites (Fig. 14). However, because they are pure, as there is no variation in composition, there can be no coring as with alloys. The cored dendritic patterns for alloys can seriously affect the mechanical and chemical properties of the solidified alloy. Outstanding examples are the effects on the response of the alloy to deformation. Because the composition varies, the mechanical properties across a grain, right to and including its grain boundary, also vary. When the alloy is in this cored condition, hot or cold deformation of the alloy is usually impossible. Every time this kind of alloy is forged or rolled, it is almost certain to fail.

HOMOGENIZATION

A method for relieving cored dendritic structures has been found and is called *homogenization* or *solution annealing*. The alloy is soaked at a high temperature near the melting point of *the last segment of the alloy to solidify*. By keeping the alloy at a high temperature for a long period of time, the atoms of the metal have an opportunity to move about and rearrange themselves—diffuse through the structure. Thus, areas that were previously high in one kind of metallic atom, "level out" to a uniform, average compositional value. This occurs after these particular atoms diffuse to areas containing fewer of the atoms, to establish balance (Fig. 15).

Once this homogenization of the structure has taken place, the alloy is in a considerably more favorable position to be deformed without rupturing. However, a word of caution—homogenizing is not a "cure-all". It is possible to *solution anneal* an alloy and not have it respond to being deformed. It will break up upon being forged or rolled. This can result from a variety of causes, including:

a. Foreign inclusions such as oxides, impurities, contaminents. . . .
b. Unfavorable atomic structure (*AM*—Sept 28 '53, p 139)
c. Brittle constituents in the alloy
d. Unfavorable grain size
e. Lack of inherent strength to withstand deformation

An example of cored dendrites in an alloy is a 70% Ni plus 30% Cu alloy. This composition is almost that of the famous copper-nickel alloy known as "Monel". The first crystals solidifying from a melt of this composition would be rich in nickel, 80%, and would freeze out at about 2500 F. The last part of the alloy to solidify would be made up of only about 55% Ni and would freeze at approximately 2420 F. By solution annealing this alloy, the structure seen under the microscope, *microstructure*, is changed in a striking manner, (Figs. 16 and 17). The areas high in nickel have "levelled out" and the areas low in nickel have "filled in". The alloy is now in a condition where it can more readily be deformed.

In addition, the alloy will more uniformly resist chemical attack.

The original non-uniform chemical composition could give rise to galvanic action or corrosion. Here two areas dissimilar in composition act as the plus and minus poles of a battery. A bit of moisture would act as an electrolyte, the substance conducting the electric current, and the "battery" would start functioning. During the process, the area of alloy acting as the plus pole would be "eaten" or corroded out.

As described for *pure metal solidification* alloys also can suffer from "hot-shortness". As with pure metals having low melting point impurities at the grain boundaries, as-cast alloys have the lowest melting point compositions at the grain boundaries for cored structures (or in-between the "branches" of the dendritic structures). If an alloy is heated just above the melting point of this last-to-freeze constituent it melts. The alloy then loses almost all the coherency of its grains—the grains no longer "stick" together with any strength. The slightest amount of stress applied to the alloy when it is in this condition causes it to break along the grain boundaries. This is identical to the hot-shortness effect previously discussed under "pure metal". However, hot shortness occurs, not primarily because a low melting point *impurity* is rejected to the boundaries, but rather because of the chemical non-uniformity of the alloy. The 95% Al plus 5% Si alloy described can be taken as an illustration to show how hot shortness can exist. The first single

phase crystals solidifying at 1130 F are quite different from those finally solidifying. The last bit of alloy to freeze at 1075 F comprises a mixture of both alpha and beta phases in what is known as the "eutectic" or lowest melting point constituent. If this alloy were heated to a temperature below 1075 F it would have strength and conceivably could be deformed at the high temperature. However, heating the alloy to 1080 F would cause the eutectic to melt. This eutectic is at the grain boundaries of the alloy and while solid is "cementing the grains together". Once the eutectic melts, the cementing effect is reduced so drastically that deformation will cause failure of the alloy. If the alloy is homogenized then the compositional variations will even out and the eutectic at the grain boundaries will no longer exist as a eutectic. Now the alloy will consist of about 97% of alpha phase which is ductile and 3% of beta phase which is brittle but is uniformly distributed in the alpha. Heating to above 1075 F will again cause partial melting, but now melting will be confined to the areas immediately around the beta particles and not the grain boundaries. This effect is called *burning* and in the Al industry, "rosetting". Burning is objectionable and usually leads to reduction in the strength of the alloy and sometimes to blistering. However, the alloy does not necessarily fall apart when hot deformed as is the case where partial melting occurs at the grain boundaries of a hot-short alloy.

As in pure metals, very rapid freezing of an alloy usually lowers the alloy's solidification temperature range. In addition, the constituents freezing out of the melt vary in chemical composition, as compared with those solidifying from a slowly-cooled melt.

An example would be the Al-Si system: For the alloy of 95% Al and 5% Si, the last bit of metal to solidify (the eutectic in this case) from a melt slowly cooling would contain 11.7% Si. The solidification temperature would be 1075 F. If this same alloy were rapidly frozen, the composition of the last part of metal to solidify would be as high as 13 or 14% Si. In addition, the temperature for final solidification would be about 35 F lower or 1040 F. Homogenizing this alloy would bring it to a condition where these super-cooled factors would be non-existent — the initial melting point of the alloy would again be 1075 F and there would be no eutectic areas containing 13 to 14% Si. In fact, as discussed before, the eutectic would no longer exist. Rather, an alloy is formed which contains 97% of one phase, alpha, with 3% of another phase, beta, distributed through it.

Equilibrium or constitution diagrams

The critical points or temperature pauses that a pure metal or alloy exhibits during cooling from the melt to low temperature has been put to excellent use by the metallurgist. Normally, two (or more) pure metals are prepared as a series of alloys of varying percentage compositions. For example, a series of tin (Sn) and lead (Pb) alloys are made, using increasing quantities of tin in the order of 10%. Thus, the first alloy contains 90% lead—10% tin, the second 80% lead—20% tin, and so on until the last alloy comprises 10% lead and 90% tin. Each of these alloys, in turn, and including pure lead and pure tin are melted, allowed to slowly cool, and notes are made as to the temperature at which the thermal arrests (critical points) occur (Fig. 18). Once these cooling curves are obtained, the critical temperatures are plotted for various alloy compositions.

When these points are connected and the areas are labeled (Fig. 19) we have what is called the *equilibrium*, or *constitution diagram*, of the lead-tin system. The equilibrium diagram represents a "map" of the conditions which exist in the alloy at any temperature and composition. Thus for a 20% lead—80% tin alloy, we observe that at 600 F the alloy is molten. At about 470 F the alloy consists of tin plus liquid, the liquid being made up of lead and tin. At temperatures below 360 F, the alloy consists of a solidified mixture of tin and lead, (Fig. 19).

Note the alloy composition 40% lead and 60% tin. At 400 F only liquid is present. However, at 360 F the liquid completely solidifies at this one temperature, as does a pure metal, into a mixture of lead and tin. Thus, for this composition, no temperature range on the map exists which shows solid and liquid existing together as did the 20% lead—80% tin alloy. The composition of this alloy which solidified at one temperature and not over a range of temperatures is called the *eutectic* of the system. Note that the eutectic happens also to be the lowest melting (or freezing) concentration (alloy composition) of the system.

By having the equilibrium diagram of an alloy it is possible to predict, among other things, approximately how it can be: heat treated, deformed both hot and cold, and what should be seen under the microscope. For a 3% copper alloy at temperatures below about 850 F two phases should exist: Alpha Al with a small amount of copper in solution with it (just as sugar is dissolved in water) and theta, a hard, brittle compound of Al and copper, $CuAl_2$. If this alloy is heated to 1000 F, all of the $CuAl_2$ dissolves in the alpha as only alpha exists at this temperature and composition. If we cool this alloy very rapidly—water quench, it is possible to "freeze" the $CuAl_2$ in solution with the alpha. From

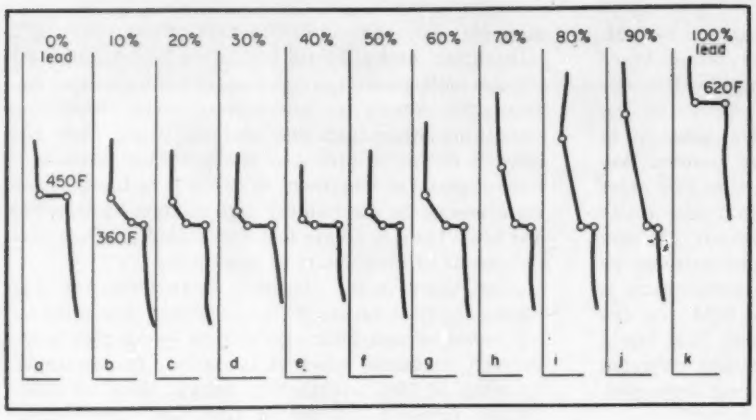


FIG. 18.. PLOT OF DISCONTINUITIES (temperature vs composition giving phase diagrams) shows 11 cooling curves for varying percentages of lead in tin-melting points for soft solder

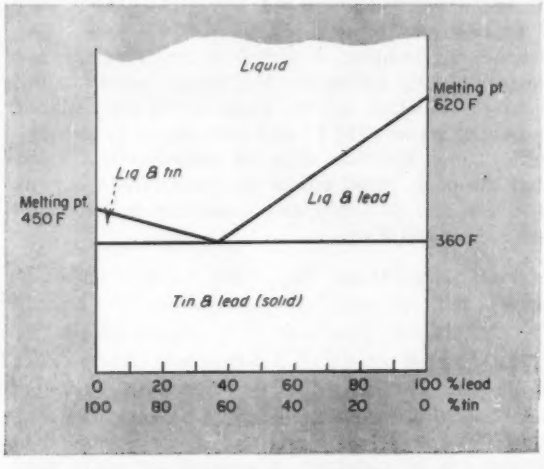


FIG. 19.. CONSTITUTION OR EQUILIBRIUM DIAGRAM for tin-lead alloy is based on melting point scale for varying percentages of lead and tin. Eutectic point at 40% lead-60% tin is lowest point at which alloy is entirely molten; hence popularity of this composition for soft solder

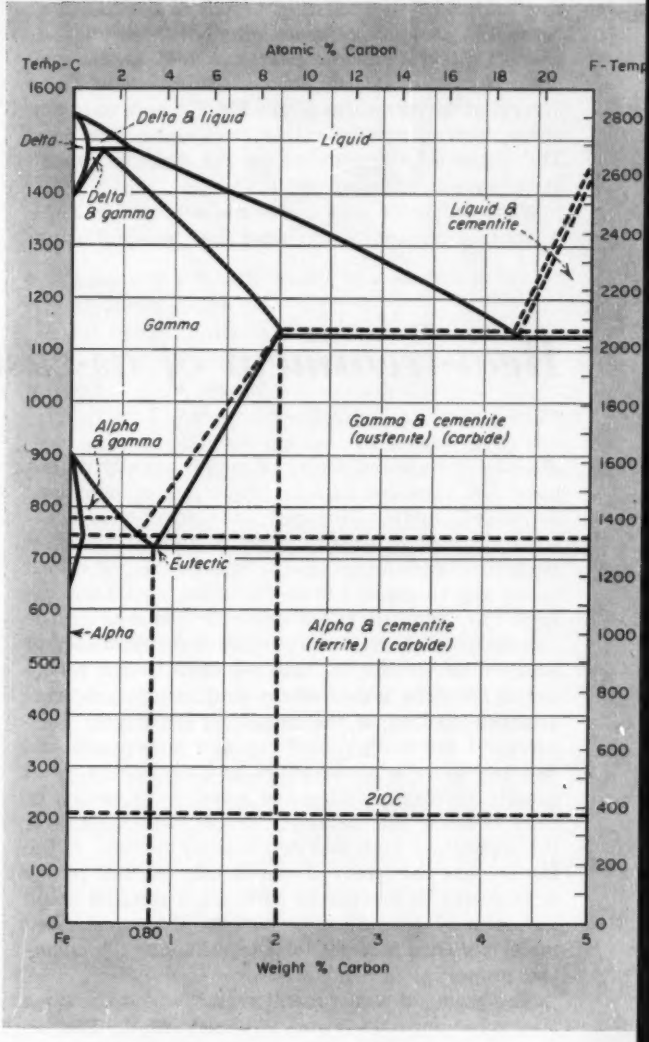


FIG. 20.. IRON-CARBON EQUILIBRIUM DIAGRAM

the diagram we know that this is not a true equilibrium condition; that the $CuAl_2$ "desires" to come out of solution; that the alloy is in a non-equilibrium or *metastable* condition. Then if we heat the alloy for eight hours at 350 F, the $CuAl_2$ comes out of solution such that true equilibrium now exists. However, instead of having large $CuAl_2$ particles scattered through the alpha, as would occur by the normal technique of cooling slowly from 1000 F, the $CuAl_2$ comes out as submicroscopic particles, uniformly dispersed through the main constituent, *matrix*, of alpha. This new dispersion very considerably hardens the alloy and gives the alloy a greater potential use. The phenomenon described is called *precipitation hardening* and is used to harden many alloys, including duraluminum. Without the equilibrium diagram, the required technique for accomplishing this end result would not be readily accomplished.

The first example shows one of the many heat-

treating uses to which these diagrams can be put. Another use is for determining the temperature above which an alloy cannot possibly be hot deformed without permanent damage. Refer to the Iron-Carbon diagram for a steel (iron plus up to 1.7% carbon is steel) of 0.5% carbon content. Assume that you receive this alloy and that you must deform it hot, perhaps forge it. Without any available information, other than the diagram, you can determine that the maximum temperature to be used must be below 2580 F. If this temperature is exceeded, the alloy is placed in the field (on the map) containing solid plus some liquid. This liquid destroys much, if not all, of the metallic cohesion and the metal can rupture while being deformed. The metal becomes hot short or is "burnt".

Perhaps you desire to deform a 55% copper—45% zinc alloy and to do it cold or hot is the question. Normally, an alloy *deforms best when one phase is present rather than two phases.* A look at the diagram suggests that the correct choice would be to deform at temperatures above 900 F where only one phase, beta, is present rather than alpha plus beta. The latter condition exists on the diagram "map" at temperatures below 900 F.

What should be seen under the microscope? Here is another advantage extended by the equilibrium diagram. For the copper-nickel system, only one constituent, alpha, exists below the region containing the melt-plus-alpha phases. If a microscopic examination shows a non-homogeneous condition, something other than one uniform phase, then the alloy is not at equilibrium and probably requires a homogenization treatment to bring it to the uniform state where its mechanical and chemical properties are best. Thus, a single test and treatment can save thousands of man-hours of machining.

Also, there is the *Magnetic Transformation* line on the Cu-Ni diagram. This line shows where an alloy becomes non-magnetic during heating or, conversely, magnetic when it is cooled. For example, an alloy of 70% nickel-30% copper loses its magnetism (crosses the dotted line) at temperatures from 100 F up. Cooling this alloy below 100 F causes its magnetism to be restored.

This knowledge was put to use in a radio tube production problem. A series of small parts supposedly of 70% nickel and 30% copper were causing erratic production results. These pieces were placed in boiling water (212 F) and were found to be magnetic. The equilibrium diagram immediately showed that the piece could not be the designated alloy, as a 70% nickel-30% copper composition is non-magnetic from 100 F up.

Heat-treatment of as-cast metals

As-cast metals and alloys of metals usually do not have the high mechanical properties of deformed (wrought) metals. However, it is possible to heat-treat castings to greatly improve these properties. Basically, a number of the treatments described above can be applied to as-cast pure metals and alloys. For instance, cored dendritic castings can be homogenized. This evens out the non-uniformity of composition as well as relieves any stresses set up in the metal by non-uniform temperature gradients (uneven cooling of the metal). Pure metals (uncored) if unevenly cooled can also be stressed and can be given a stress-relief heat-treatment. This usually involves heating the metal for a period of time to allow the metal to *recover,* which removes the sometimes high and detrimental stresses. If the stresses are not removed, the casting can fail (crack or rupture) in service. In addition, a stressed metal will usually corrode more rapidly than unstressed material. Thus stresses tend to influence the chemical properties of a metal.

The grains of a cast metal remain about the same size even when the metal is heat-treated. That is, cast metals do not exhibit grain growth when they are heated to increasingly high temperatures. Exceptions to this occur if the metal is in a stressed condition or goes through an allotropic change. Then there is a possibility of grain changing size. Smaller grains can be obtained in castings by rapid melt solidification. The faster the freezing, the finer the grain sizes.

Certain as-cast alloys can be precipitation hardened (aged) as described in the discussion of the hardening of an aluminum-copper alloy. This operation can markedly improve the strength of an alloy. (Cast aluminum alloys have been aged to 50,000 psi and higher tensile strength.) However, not all alloys can be precipitation hardened nor can any of the pure metals be so hardened.

A number of pure and alloyed metals exhibit the allotropic (crystal structure or atom geometry) changes as discussed previously in the cooling curve presentation. The cast metals will show these changes if heated past the critical point for an allotropic change. In addition, heating certain alloys can change the arrangement of the phases. These can be used to advantage to change an existing detrimental structure into one of less objectionable characteristics. Cast irons are heated between 1200 and 1500 F to soften and improve their machinability. Steel castings are heated at temperatures ranging from approximately 1500 F for high-carbon steels (up to 1.7% carbon, balance iron) to 1650 F for low-carbon steel to reduce the grain size (refine the grain structure). Usually, the finer the grains the greater the mechanical strength.

Round Table

Little black book

"You can't fire a good man just because he has illusions of intelligence, Al. Why not just ignore Smith—he doesn't give you much trouble."

"The heck he doesn't, Ed! He has half the shop believing that he's the only one who has such data as standard times for machining operations and jig and fixture details. He claims the company can't get along without him; and some of the gang actually believe him."

"Don't they realize that standard times are calculated by Methods, and that all jig drawings are on file?"

"Some of them do, but I'm not sure Smith doesn't have the others convinced, even in spite of the fact that Morse and some of the other old-timers have given him the horse-laugh."

"It's just a silly situation, Al. Why not get them together and tell them the truth? Lay it on the line, and never mind if Smith gets hurt. He's just asking for trouble if he tries anything as stupid as that."

"I'm not sure I should, Ed. If I get the gang together, it might make the whole thing more important than it really is. Then the guys who don't believe me will really be convinced Smith has an inside track."

"But firing Smith will make the thing important. After all, he does his work, and you really haven't a good reason for letting him go."

"Maybe I have, Ed. Smith is doing what amounts to undermining my authority with the men. If he tells them he's so valuable to the company he can't be fired, and they believe him, who are they going to pay attention to: him or me?"

"If they've got any sense they can answer that one easy."

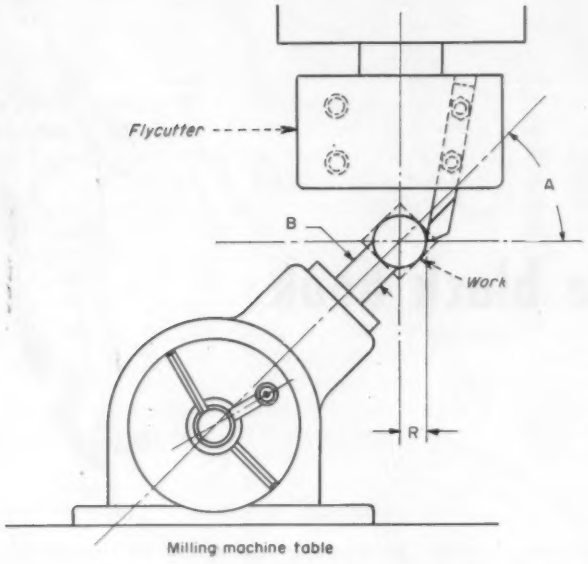
"Sure, but some of the guys are new and haven't much knowledge of how the company works. He has a lot of data in his little black book—it's right and it's valuable, and he does give it to the men. I've even gotten some from him, to save a trip to the files."

"How about telling Smith off; maybe in front of the men? That would squelch him — and tip them off that he isn't so vital."

"I suppose that might work, but I'd be taking the chance that he might claim I was picking on him."

***IS SMITH TOO FAR GONE** in his outrageous ideas to be worth keeping in the company, or would firing be unjust? How can Al best straighten out the men who half-believe him? Your ideas on the subject may interest others. Discussions of earlier topics appear on later pages.*

Practical Ideas . . .



Rotating Flycutter Mills Spheres With Single-Point Tool

The prize-winning Practical Ideas (*AM*, Mid-November, 1953, p G2) showed a method of cutting spherical shapes. I would like to suggest an alternate method which uses the advantage of a single-point tool, reducing friction and tool wear. This method also gives greater accuracy, because it doesn't depend on the accuracy of a preformed shape. Also, the tools and equipment—milling machine, dividing head, and flycutter—are common to all tool and die shops.

The setup is quite simple, but alignment of the centerline of the sphere and milling machine spindle is most important, especially if concentricity of sphere and shaft diameter is to be held to close limits.

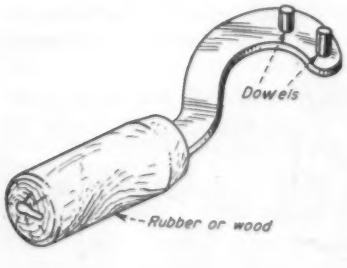
To cut the sphere, indicate the blank true to the dividing head spindle. Then put the toolbit in the flycutter, setting the tool so that the distance from the tool point to the centerline of the milling machine spindle is equal to the desired radius of the sphere.

The angle to which the dividing head is set is found with the formula: $\sin A = \frac{B}{2R}$

where B is the shank diameter, and R is the radius of the sphere.

Using a "wiggler," it is now possible to align the centerline of the sphere with the milling machine spindle.

Putting the flycutter in the machine spindle, bring the point of the toolbit to the centerline of the sphere, begin the cut, and rotate the workpiece with the rotary table. A sphere will be generated by the tool point. *Louis Saiia, San Bruno, Calif*

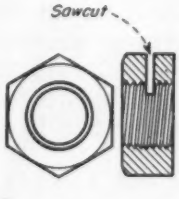


Special Spanner Wrench Avoids Chuck Damage

Snapping off chuck keys, breaking adjustment screws, or ruining jaws of chucks by placing a bar between them to remove the chuck is expensive and dangerous, risking the accuracy of the chuck. and the possibility that the operator may damage his hands or the spindle bearings of the lathe.

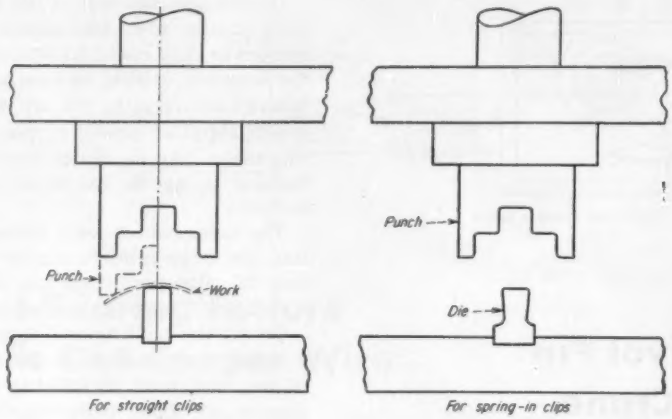
To avoid this, we made a special spanner wrench to remove the chuck.

This wrench is simple, practical, and inexpensive. First, drill two holes in the back of the chuck body, as shown. Then make the wrench, drill two corresponding holes in the wrench body, press hardened dowels into the wrench, and make a rubber or wooden handle to protect the wrench when the chuck breaks loose. *Richard Cataldo, Malden, Mass*



Simple Locknut Method

A simple and inexpensive way to lock a nut is to make a slot in the side of the nut, using a hacksaw. After the nut is screwed on, close the slot with a nailset punch. To open the nut, simply insert a chisel into the closed slot and open the nut to its original shape. *Federico Strasser, Santiago, Chile*



For straight clips — For spring-in clips

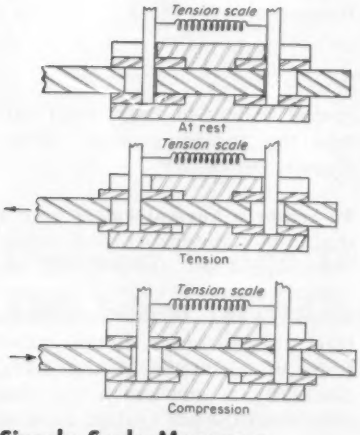
Simple Die Change Cuts Springback

A number of tools and dies have been described in Practical Ideas for eliminating springback when forming U-shapes or channel sections, but most of them have been relatively complicated.

The forming die is quite straightforward. The punch is designed to bow the clip before the forming edges contact the die. This bow will persist in the forming, so there will be a slight excess of metal in the gap of the forming punch.

The tool is set so the punch hammers slightly on the die and hits this excess metal, and when the clip is removed, it will be found to be perfectly formed.

By increasing the lead on the punch, giving more bow to the metal, and undercutting the die, it is possible to produce clips with sprung-in sides. *P V Dunn, Johannesburg, S Africa*



Simple Scale Measures Compression And Tension

This simple device will measure both compression and tension but uses only one spring and scale. The device is made of a round shaft which has two elongated slots, to clear two pins which are pressed into two sleeves. The tension spring is hooked between the pins, and measures the force in either direction. *Chris Stougaard, Racine, Wis*

If worn file handles have to be repaired in a hurry, drive a suitable wooden dowel plug into the handle, or ream out the handle to suit whatever dowels are on hand. Drive the file into the tightly plugged handle, and it will hold the file securely for some time. *William Adams, Bayside, L I*

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JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

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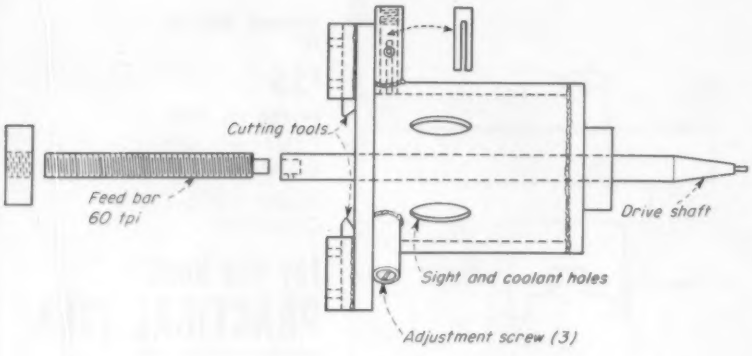
HOW TO ENTER—Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N Y



In-Place-Machined Pivot Pin Saves Downtime Of Crane

We had to machine the pivot pin of a large carrier crane, and couldn't spare the two or three weeks it would have meant to completely take the crane apart and replace the pin. Instead of this, we machined the pin in place.

The OD of the 6-in. diameter, 10-in. long, pin had to be machined ⅛-in. smaller, to remove out-of-roundness, and had to be held true and perpendicular within 0.020 in. to a 72-in. diameter machined surface on which the crane revolved.

Because the pivot pin was machined inside and out, our first step was to make a quill to fit the ID of the pin, and to attach a dial indicator and arm to check alignment. The quill could then be used to keep the cutting tools aligned.

The cutting tool was a combination of flycutting hollow mill and cat's paw. It was made of steel tubing, a shaft, two steel plates, and three brass bearings. The ID of the tube was 1 in. larger than the OD of the pivot pin. On the face of the tubing we welded a ⅝-in. steel plate, to which we welded two steel blocks to receive two ½-in. toolbits. On the back face of the flange we welded three steel tubes 120° apart. Then we drilled through the main tube, to supply cutting oil and to set the bearing with adjusting screws. The brass bearing had a slot milled to hold keys which were threaded into the three outer tubes, to prevent the bearings from turning with the toolholder.

On the opposite end of the main tube, another plate and collar were welded so they could be secured to the drawbar, which, in turn had a tapered shank to fit the air motor which supplied power to the cutting tools. (An air motor was used because its speed was easily controlled.)

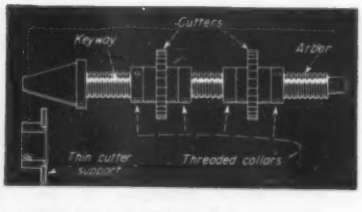
The holes, which were flame-cut into the large tube, to supply cutting oil, also permitted visual inspection of cutting taking place.

To set the toolbits and bearings, a collar was made to fit the shaft of the tool, with its OD the same size as the finish diameter of the work.

Two cutting tools were used—a standard roughing tool, and a round-nosed finishing tool, to smooth out the roughing-tool marks. The tools were mounted in front of the three jaws, which acted as a steadyrest for the tool assembly.

The tool was fed by a ¾-in. rod threaded 60 tpi. A nut of like thread was secured to the opposite end of the work, so the rod would pull the tool into the work during cutting.

The job was finished in two hours after the tool was made and the pivot pin cleared for machining. It would have been a couple of weeks to put in a new pin. *Peter Cervelli, Plainview, NY*



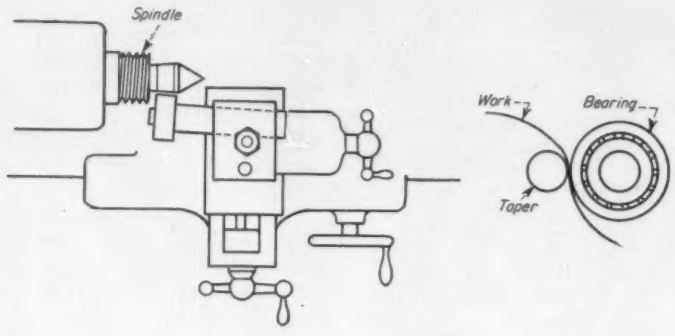
Threaded Arbor Saves Straddle-Mill Setup Time

We do quite a bit of straddle-milling, and find that setting up and adjusting cutters takes more time than we can spare for it. To avoid this problem we have made a threaded arbor (Acme thread), and a number of threaded collars. These collars are drilled to take a spanner wrench.

To assemble the arbor, the cutters are mounted on the arbor, and an unthreaded, slotted collar is placed on either side of each cutter. A key in the slot of the collar and arbor prevents torque from the cutters loosening the nuts.

With this arrangements it is a simple matter to loosen one nut and tighten the other to move the cutter over as required. Very narrow cutters must be supported in a special collar, so they won't fall into the thread grooves. *Henry George, Bronx, NY*

To center a keyseat cutter over a shaft, in maintenance and repair work, use a pin to space off the distance from the edge of the cutter to the edge of the work. Subtract the thickness of the cutter from the diameter of the shaft, divide by 2, and use a pin that size. Hold the pin against the cutter, bring the square up to it, then move the work over to touch the square. *F Moser, Keokuk, Iowa*



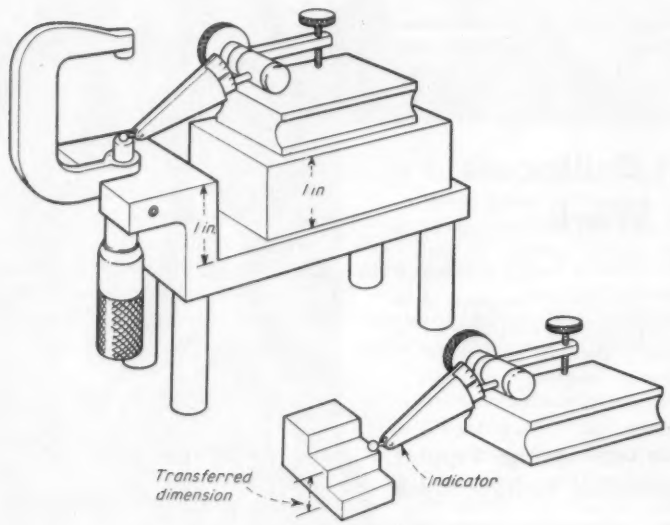
Ball-Bearing Fixture Rolls Out Copper Wire

We had to have some thin copper strip for experimental work and didn't have a suitable mill. Therefore we adopted the method shown above, in which a ball-bearing and lapped shaft squeezed the wire.

A small ball-bearing was pressed onto a shaft, and the assembly was clamped securely in the toolpost. The regular hardened taper was inserted in the spindle hole, and a portion of the taper was lapped to improve the surface finish.

By advancing the cross-slide, the outer race of the bearing was pressed against the polished part of the taper. The lathe was started, and thin copper wire was fed between the bearing and taper. Thickness of the strip resulting was varied by changing the pressure.

The first job we tried this rolled 0.040-in. diameter copper wire to a strip 0.010 in. thick and 0.100 in. wide, and the work came out with surprisingly uniform size and finish. Since then we have done several other jobs, including strips of brass and bronze up to 0.180 in. wide. *M Barash, Haifa, Israel*



Stepped "Gage Table" Aids Form Grinding

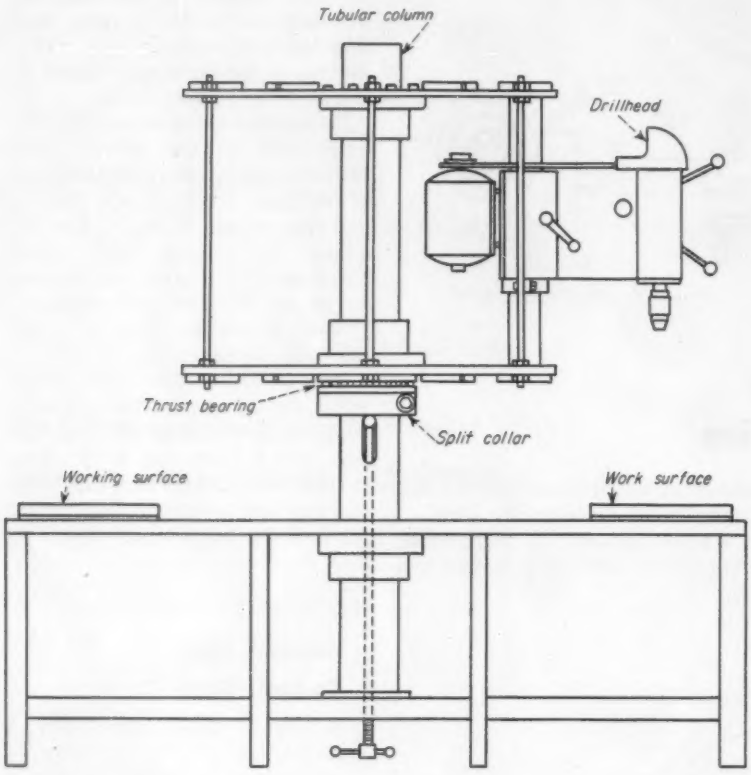
The attachment shown is very handy for getting an indicator reading from a "tenth" micrometer, for form grinding. As long as the step on the table is exactly 1.000 in. (to gage tolerances) the table has a range from zero to ⅞ in. and, when the 1-in. block is removed, from 1 to 7⅞ in. When size blocks are not available, this will be found to be a good substitute. *Frank Geiger, Brooklyn, NY*

Another Way To Lock Vises

A recent Practical Idea (*AM*, Jan 4, '54) described a hammer-handle to tighten milling machine vises. To do the same job, we cut a triple-lead square thread in the ID of a heavy steel hub, and pressed a handwheel on the hub OD. Then we cut a mating thread on the OD of a sleeve, the ID of which was drilled and filed to fit the square end of the vise. The outer end of this sleeve was knurled, and the sleeve was pinned in place.

The handwheel and hub were screwed on the sleeve, kept in place by a pinned collar.

To use the vise, put the work in place, close the vise with the knurled sleeve, and spin the handwheel, running the wheel up the thread. Flywheel-like momentum when the wheel strikes the end of the sleeve twists the sleeve tight. Reversing the process unlocks the work. *G H Koslow, Bronx, NY*



Improvised Six-Station Drillpress Speeds Single-Spindle Work

Although we have several multi-spindle drillpresses in use, we found that we needed extra drilling capacity, and decided to put some single-spindle bench drills to work on production jobs.

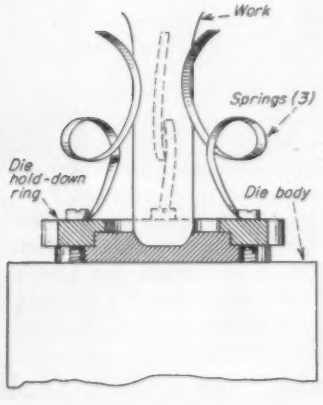
We flame-cut two disks from hot-rolled steel, tack-welded the edges together for machining, and bored holes to fit the drill columns and a central tubular support. The plates, spaced by threaded rods, were then secured to bronze-bushed steel hubs and mounted on a tubular column.

The lower hub rested on a ball thrust-bearing made from two hardened and ground plates and a brass ring drilled to take the steel balls. A center screw bearing against a cross-pin provided vertical adjustment. This cross-pin bears against a split collar which clamps in place on the central column.

Clamp rings are bolted to each plate to give a means of clamping the drillpress columns. (Only one drill is shown, but actually there are six machines altogether.) The drillheads are individually adjustable for height.

The entire unit is mounted on an angle-iron table. A ground plate at each end of the machine gives the working surface. These plates are shimmed to level.

In use, each drill carries a different type of drill or tap, and, as one operation is finished, the operator swings the next station into place and proceeds with another step in the job. Ordinarily we have one operator on this unit, but occasionally we have two men, one at each end, with identical jigs, working on the same operations. *Clifford Molloy, Bronx, NY*



Three Leaf Springs Support Thin-Walled Redraw Work

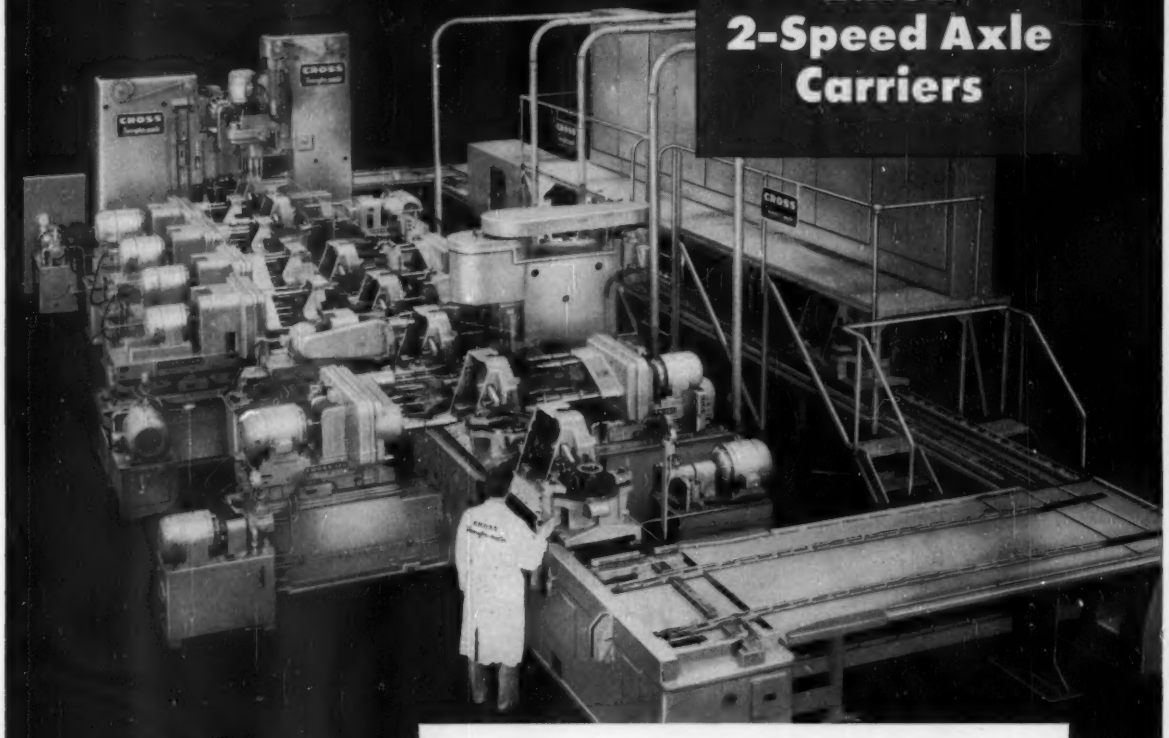
When redrawing thin - walled shells, it is often impossible to use a blank-holder, because of the danger of breaking through the thin walls of the shell. In these cases, it is customary to use a stick or hold the work up by hand. Neither of these ways to guide the work is very satisfactory, and the result can be either cracked and jammed shells, or a damaged die or punch.

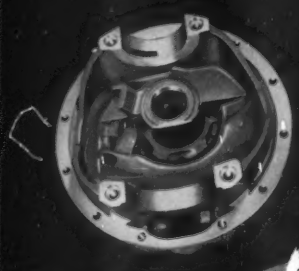
To avoid this trouble, we have rigged three flat leaf springs to the die hold-down ring. These springs support the work before the ram descends, and flare out as the edge of the shell passes.

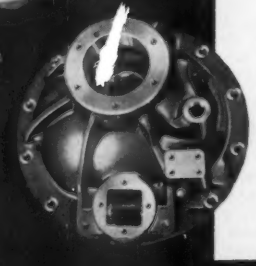
Hardly any pressure is needed by the operator to push the shell past two of the springs and against the third spring in back. This saves us quite a bit of time, and we no longer have the problem of broken shells or damaged dies and punches; also, the operators on this job are much less subject to fatigue because of extra care needed to hold the pieces upright. *Charles Schwartz, Brooklyn, NY*

Another Transfer-matic by Cross

Mills, Drills and Taps Eaton 2-Speed Axle Carriers







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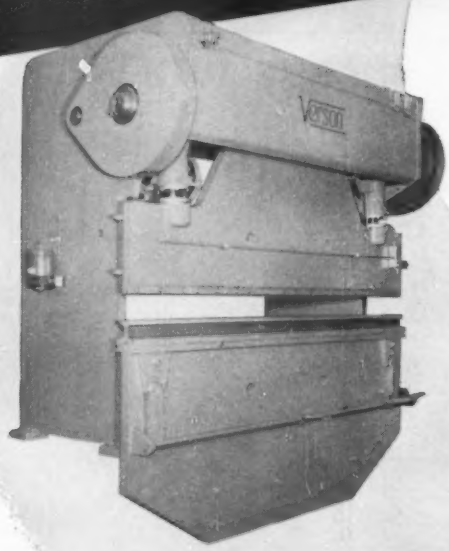
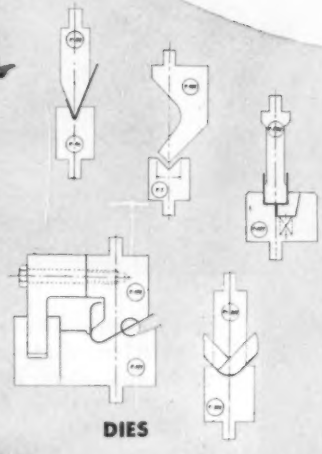


PRESS BRAKES



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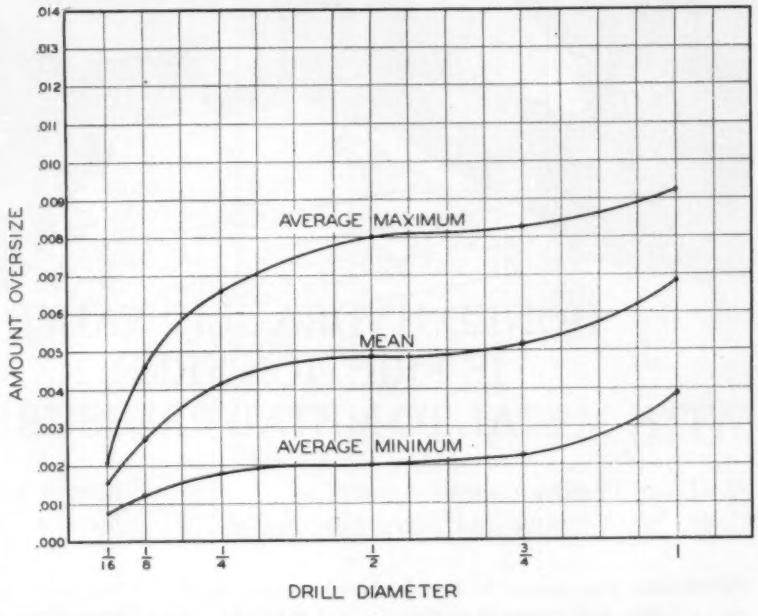
Tolerances for Tap-Drill Holes... I

Source: "Drilled Holes for Tapping," published by the Metal Cutting Tool Institute

When the engineer selects a tap drill, he does so on the basis of percentage of thread. Existing tables of tap-drill sizes do not show the amount of oversize that a drill may be expected to cut, and the probable percentage of thread, as compared to the theoretical percentage of thread. Thus, the engineer is unable to apply a tolerance to drilled holes.

To arrive at reasonable data on the actual sizes cut by tap drills, extensive tests have been conducted by the Drill & Reamer and the Tap & Die Divs of the Metal Cutting Tool Institute. Typical results are plotted on this page, and the probable mean oversizes for drills from 0-80 to 1⅛-12 are given on pages 145 and 147. With good drilling practices and reasonable care in resharpening, the average shop may expect to drill oversize with similar deviations. No bushings were used in the tests, but reasonable care was exercised to avoid "walking."

When drilling holes over ¾ in. in dia, the normal oversize and deviations in drilling increase to such an extent that reaming is recommended for maintenance of close minor-diameter tolerances. Reaming is also recommended where a higher degree of uniformity and accuracy is required.



EVEN PROPERLY GROUND and used drills will cut oversize by amounts that vary with tool diameter. Tests were made on cast iron and steel. Results on soft metals and plastics will differ

FACTORS AFFECTING ACCURACY

Although there are cases where holes are drilled in production with accuracy and uniformity, such results cannot be generally expected. A drill is a roughing tool. Reamer accuracy must not be expected of of a drill. Nevertheless, a drill can often be made to cut more accurately than it does. Observance of the following factors will permit the drill to meet minor-diameter requirements for tapped holes.

Drill Point. If the drill is sharpened with unequal lip angles, the lip with the greater lip angle does most of the work. The reaction forces the opposite margin into the wall of the hole. If the drill is sharpened with unequal lip lengths, the drill sweeps with one margin rubbing against the hole. Both conditions frequently exist simultaneously, and the resulting hole is any imaginable size or character. Web thickness is likewise important. A thick web requires a high thrust to penetrate the work material, but too thin a web makes the tool so free-cutting that it may cut a bell-mouth hole. Good practice is to thin the web to 10 to 12% of the drill diameter.

Drill Modifications. Standard drills are made for general-purpose use. The points are often modified to cut various materials. If you notch a drill to transform the chisel edge into secondary cutting lips, the point cuts freely and cannot be started accurately without the aid of a bushing. Even with a bushing, these drills cut considerably oversize. Notched drills are not often used for holes that have to be tapped, but you should know what to expect in regard to probable hole size if cases arise where it seems desirable to use a notched drill.

Material Drilled. Drills cut larger holes in soft materials like magnesium and plastics, than they do in hard materials, because the stabilizing effect of the chisel edge and the margins is reduced. The wall

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HONING MAY BE *YOUR* ANSWER, TOO . . .

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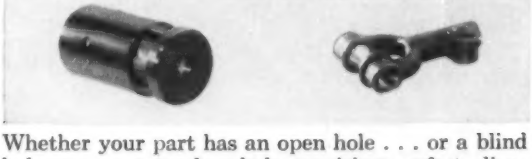

Whether your part has an open hole . . . or a blind hole . . . or a tandem hole requiring perfect alignment, Sunnen Honing can help you. Accuracy is guaranteed to within .0001″ . . . surface finishes as low as 2 micro-inches RMS in hardened steel. Diameter range is ⅛″ to 2⅝″.

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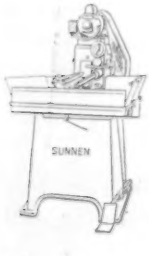

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Tolerances for Tap-Drill Holes... II

Probable Percentage of Full Threaded Produced in Tapped Hole Using Stock Sizes of Drill

Tap	Tap Drill	Decimal Equiv. of Tap Drill	Theoretical % of Thread	Probable Oversize (Mean)	Probable Hole Size	Percentage of Thread
0-80	56	.0465	83	.0015	.0480	74
	3/64	.0469	81	.0015	.0484	71
1-64	54	.0550	89	.0015	.0565	81
	53	.0595	67	.0015	.0610	59
1-72	53	.0595	75	.0015	.0610	67
	1/16	.0625	58	.0015	.0640	50
2-56	51	.0670	82	.0017	.0687	74
	50	.0700	69	.0017	.0717	62
	49	.0730	56	.0017	.0747	49
2-64	50	.0700	79	.0017	.0717	70
	49	.0730	64	.0017	.0747	56
3-48	48	.0760	85	.0019	.0779	78
	5/64	.0781	77	.0019	.0800	70
	47	.0785	76	.0019	.0804	69
	46	.0810	67	.0019	.0829	60
	45	.0820	63	.0019	.0839	56
3-56	46	.0810	78	.0019	.0829	69
	45	.0820	73	.0019	.0839	65
	44	.0860	56	.0019	.0879	48
4-40	44	.0860	80	.0020	.0880	74
	43	.0890	71	.0020	.0910	65
	42	.0935	57	.0020	.0955	51
	3/32	.0938	56	.0020	.0958	50
4-48	42	.0935	68	.0020	.0955	61
	3/32	.0938	68	.0020	.0958	60
	41	.0960	59	.0020	.0980	52
5-40	40	.0980	83	.0023	.1003	76
	39	.0995	79	.0023	.1018	71
	38	.1015	72	.0023	.1038	65
	37	.1040	65	.0023	.1063	58

Tap	Tap Drill	Decimal Equiv. of Tap Drill	Theoretical % of Thread	Probable Oversize (Mean)	Probable Hole Size	Percentage of Thread
5-44	38	.1015	79	.0023	.1038	72
	37	.1040	71	.0023	.1063	63
	36	.1065	63	.0023	.1088	55
6-32	37	.1040	84	.0023	.1063	78
	36	.1065	78	.0026	.1091	71
	7/64	.1094	70	.0026	.1120	64
	35	.1100	69	.0026	.1126	63
	34	.1110	67	.0026	.1136	60
	33	.1130	62	.0026	.1156	55
6-40	34	.1110	83	.0026	.1136	75
	33	.1130	77	.0026	.1156	69
	32	.1160	68	.0026	.1186	60
8-32	29	.1360	69	.0029	.1389	62
	28	.1405	58	.0029	.1434	51
8-36	29	.1360	78	.0029	.1389	70
	28	.1405	68	.0029	.1434	57
	9/64	.1406	68	.0029	.1435	57
10-24	27	.1440	85	.0032	.1472	79
	26	.1470	79	.0032	.1502	74
	25	.1495	75	.0032	.1527	69
	24	.1520	70	.0032	.1552	64
	23	.1540	67	.0032	.1572	61
	5/32	.1563	62	.0032	.1595	56
	22	.1570	61	.0032	.1602	55
10-32	5/32	.1563	83	.0032	.1595	75
	22	.1570	81	.0032	.1602	73
	21	.1590	76	.0032	.1622	68
	20	.1610	71	.0032	.1642	64
	19	.1660	59	.0032	.1692	51

of the hole, in magnesium for example, may have repetitive projections and depressions. Remedies for this situation are to change the style of the drill or to follow the drill with a reamer. Copper tends to close in and produce a hole smaller than the drill by thermal contraction. Thermoplastic materials exhibit the same effect because of plastic flow.

Feed. It is well known that drill speed affects hole size, but few people realize the importance of proper feed. Many materials break up in fine chips and dust, but others will form continuous chips if drilled properly. If these latter materials are drilled at too fine a feed, an abrasive dust containing work-hardened particles is created. Front taper is generated on the drill, hole sizes vary from the expected dimension and drill life is reduced.

PERCENTAGE OF THREAD

For a length of thread engagement equal to a standard nut height, the static strength of a threaded fastener is not improved by a thread percentage greater than 60% in the tapped member. Thus, hole diameter is not critical in the minor diameter range greater than 60% of thread height. As thread height increases, the width of chip and amount of material to be removed by the tap increases. In general, the external thread, or bolt, breaks at 55% of engagement. Thus, an excessive percentage of engagement is not warranted, and taps will last longer if a practical tap-drill size is selected.

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Get ⅓ or more "bonus" capacity from your screw machines with Ledloy*. Here is a free machining steel with lead added that feeds faster—finishes better—and greatly reduces tool wear. Evenly distributed, submicroscopic particles of lead act to reduce friction between tool and chip. Forgability, carburization and heat treatment are not affected and no health hazards are involved in normal machining, handling, heat treating, or forging.

Our Field Metallurgist will be glad to discuss Ledloy with you and its application to your product. Similar advantages are also obtainable through use of leaded alloy steels which are available in full range of A. I. S. I. or S. A. E. standard analyses. Call or write today for complete information.

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Steel Division

COPPERWELD STEEL COMPANY

Warren, Ohio

For Export—Copperweld Steel International Company
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Tolerances for Tap-Drill Holes... III

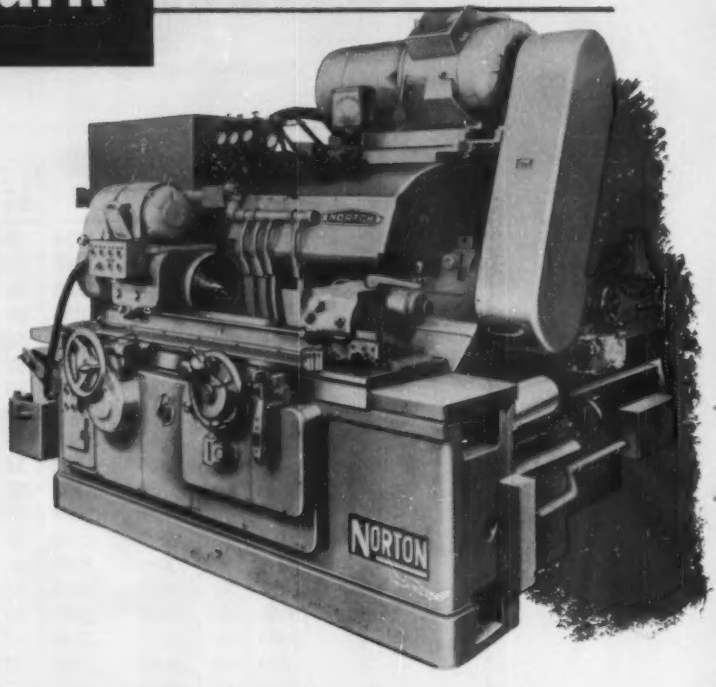
Probable Percentage of Full Thread Produced in Tapped Hole Using Stock Sizes of Drill

Tap	Tap Drill	Decimal Equiv. of Tap Drill	Theoretical % of Thread	Probable Oversize (Mean)	Probable Hole Size	Percentage of Thread
12-24	11/64	.1719	82	.0035	.1754	75
	17	.1730	79	.0035	.1765	73
	16	.1770	72	.0035	.1805	66
	15	.1800	67	.0035	.1835	60
	14	.1820	63	.0035	.1855	56
12-28	16	.1770	84	.0035	.1805	77
	15	.1800	78	.0035	.1835	70
	14	.1820	73	.0035	.1855	66
	13	.1850	67	.0035	.1885	59
	3/16	.1875	61	.0035	.1910	54
1/4-20	9	.1960	83	.0038	.1998	77
	8	.1990	79	.0038	.2028	73
	7	.2010	75	.0038	.2048	70
	13/64	.2031	72	.0038	.2069	66
	6	.2040	71	.0038	.2078	65
	5	.2055	69	.0038	.2093	63
	4	.2090	63	.0038	.2128	57
1/4-28	3	.2130	80	.0038	.2168	72
	7/32	.2188	67	.0038	.2226	59
	2	.2210	63	.0038	.2248	55
5/16-18	F	.2570	77	.0038	.2608	72
	G	.2610	71	.0041	.2651	66
	17/64	.2656	65	.0041	.2697	59
	H	.2660	64	.0041	.2701	59
5/16-24	H	.2660	86	.0041	.2701	78
	I	.2720	75	.0041	.2761	67
	J	.2770	66	.0041	.2811	58
3/8-16	5/16	.3125	77	.0044	.3169	72
	O	.3160	73	.0044	.3204	68
	P	.323	64	.0044	.3274	59
3/8-24	21/64	.3281	87	.0044	.3325	79
	Q	.3320	79	.0044	.3364	71
	R	.3390	67	.0044	.3434	58
7/16-14	T	.3580	86	.0046	.3626	81
	23/64	.3594	84	.0046	.3640	79
	U	.3680	75	.0046	.3726	70
	3/8	.3750	67	.0046	.3796	62
	V	.3770	65	.0046	.3816	60
7/16-20	W	.3860	79	.0046	.3906	72
	25/64	.3906	72	.0046	.3952	65
	X	.3970	62	.0046	.4016	55
1/2-13	27/64	.4219	78	.0047	.4266	73
	7/16	.4375	63	.0047	.4422	58
1/2-20	29/64	.4531	72	.0047	.4578	65
9/16-12	15/32	.4688	87	.0048	.4736	82
	31/64	.4844	72	.0048	.4892	68

Tap	Tap Drill	Decimal Equiv. of Tap Drill	Theoretical % of Thread	Probable Oversize (Mean)	Probable Hole Size	Percentage of Thread
9/16-18	1/2	.500	87	.0048	.5048	80
	33/64	.5156	65	.0048	.5204	58
5/8-11	17/32	.5313	79	.0049	.5362	75
	35/64	.5469	66	.0049	.5518	62
5/8-18	9/16	.5625	87	.0049	.5674	80
	37/64	.5781	65	.0049	.5831	58
3/4-10	41/64	.6406	84	.0050	.6456	80
	21/32	.6563	72	.0050	.6613	68
3/4-16	11/16	.6875	77	.0050	.6925	71
7/8-9	49/64	.7656	76	.0052	.7708	72
	25/32	.7812	65	.0052	.7864	61
7/8-14	51/64	.7969	84	.0052	.8021	79
	13/16	.8125	67	.0052	.8177	62
1"-8	55/64	.8594	87	.0059	.8653	83
	7/8	.875	77	.0059	.8809	73
	57/64	.8906	67	.0059	.8965	64
	29/32	.9063	58	.0059	.9122	54
1"-12	29/32	.9063	87	.0060	.9123	81
	59/64	.9219	72	.0060	.9279	67
	15/16	.9375	58	.0060	.9435	52
1"-14	59/64	.9219	84	.0060	.9279	78
	15/16	.9375	67	.0060	.9435	61
1 1/8-7	31/32	.9688	84	.0062	.9750	81
	63/64	.9844	76	.0067	.9911	72
	1"	1.000	67	.0070	1.007	64
	1 1/64	1.0156	59	.0070	1.0226	55
1 1/8-12	1 1/32	1.0313	87	.0071	1.0384	80
	1 3/64	1.0469	72	.0072	1.0541	66
1 1/4-7	1 3/32	1.0938	84			
	1 7/64	1.1094	76			
	1 1/8	1.125	67			
1 1/4-12	1 5/32	1.1563	87			
	1 11/64	1.1719	72			
1 3/8-6	1 3/16	1.1875	87	No Test Results Available		
	1 13/64	1.2031	79			
	1 7/32	1.2188	72			
	1 15/64	1.2344	65			
1 3/8-12	1 9/32	1.2813	87	Reaming Recommended		
	1 19/64	1.2969	72			
1 1/2-6	1 5/16	1.3125	87			
	1 21/64	1.3281	79			
	1 11/32	1.3438	72			
	1 23/64	1.3594	65			
1 1/2-12	1 13/32	1.4063	87			
	1 27/64	1.4219	72			

Another first

...For Delpark Filtration



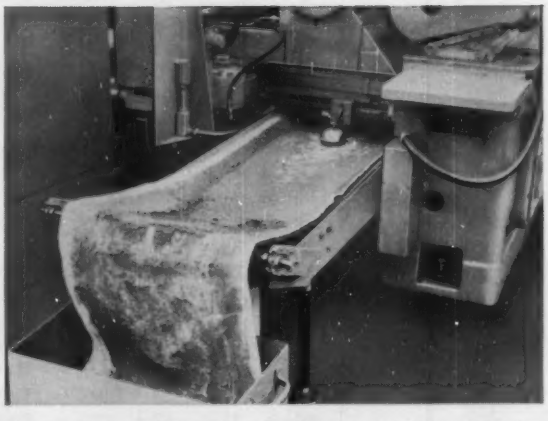
NORTON'S GRINDER Features *Built-in* Delpark Filtration

Recognition by Norton engineers of DELPARK as the finest in coolant filtration is acknowledged by the incorporating of DELPARK Filtration *into* the design of a new grinding machine introduced by Norton.

This machine is the Norton Type CM-1 Heavy Duty Semiautomatic Multi-Wheel Grinder. This unit utilizes several grinding wheels mounted between bearings for simultaneously grinding different diameters on the work piece in a single plunge-grind operation. Heavy sludge loads produced are immediately removed eliminating time loss necessary to clean reservoirs. Coolant supply is constantly kept clean and free of particles which would spoil the finish of ground work.

Thank you Norton, for your recognition of DELPARK Filtration as the finest.

Write for the Delpark brochure on Norton's new type grinder



Norton Type CM-1 Heavy Duty Semiautomatic Multi-Wheel Grinder with built-in Delpark Filtration

Delpark INDUSTRIAL FILTRATION

BACKED BY MORE THAN 30 YEARS EXPERIENCE IN INDUSTRIAL FILTRATION

INDUSTRIAL FILTRATION COMPANY, 313 INDUSTRIAL AVENUE, LEBANON, INDIANA

Talking Shop . . .

Fireman's Holiday

CINCINNATI FIREMEN work a day-on, day-off schedule. Enterprising ones hunt for off-day work. Standard Electrical Tool has two, with opposite days off, as plant maintenance men. But Carl Traeger did better than that. He set up a machine shop with a Warner & Swasey automatic, a couple of lathes and a couple of drills, and 5 or 6 other firemen to help. Doing subcontract work for Cincinnati machine-tool builders, he's had so much work he recently moved into a new 2000-sq-ft location. plans to add still more firemen to his off-day force.

Bar to Plate

WOODRUFF KEYS were once made from half-round stainless-steel bar at Standard Horse Nail Company, New Brighton, Penna. The bar was simply sawed up—but then began a long series of grinding operations to get the exact thickness required. Now the company orders stainless sheet rolled to exact thickness and simply stamps out the shape. Minimum grinding on the edges slashes costs.

Pocketed Gears

GEARS for lathe drives are carried on wooden pins set in fork-trucked skids at Lodge & Shipley. To avoid trucking dirt into the air-conditioned gear-checking room, as well as to aid in keeping temperature constant there, loaded skids are set from the outside into a floor-level pocket in the wall. Testers can then take gears individually from the skids by opening the proper one of a series of wooden trapdoors over the pocket . . . The company has also shifted its gasoline trucks to operation on propane from twin tanks behind the driver. Operation is less costly and air contamination is reduced.

30 Millionths

W & L E GURLEY, Troy, NY, make platinum wire 30 millionths in diameter by a tricky drawing process. The wire is used for crosshairs on surveying and other optical instruments, instead of spider web, which is about 0.001 in diameter, but knobby like bamboo (bacause the spider extrudes a blob, then draws it); or the finest human hair, which is 0.002 to 0.003 in. The platinum is drawn through a diamond die with an 0.003-in.-dia hole. Then about 0.030 in. of silver is plated on and the wire drawn again. When it is through the 0.003-in. die, the silver is removed with acid—and there's your fine-diameter platinum wire.

Bonus

TWO UNEXPECTED DIVIDENDS were attained with development of the Floturn process at Lodge & Shipley (*AM*—Mar 29 '53). The first is that the process acts as its own inspector. The progressive displacement of molecules during cold forming inevitably exposes gas pockets, slag inclusions, or other flaws in the material, showing either a surface blemish or a crack. In one case, stainless plate that had been giving trouble in service when formed by previous methods was found to contain serious flaws in two-thirds of a trial batch of pieces. Specifications for the plate were changed as a result . . . The second dividend was the discovery that for each material and form there is an optimum rotational speed. Heat generated by roll forming goes up as speed is increased, but there is an optimum speed, predictable for each job with experience, at which relatively little heat is created. This is like metal-cutting practice, in which machining at the optimum temperature results in minimum heating of work and tool.

Milling at 6300 FPM

TO PRODUCE flat brass plates for the jewelry industry, one company recently did some spectacular machining. Shop men replaced the usual 6-in. wheel on a vertical-spindle face grinder with an 8-in.-dia cutter, then fed the brass through under it as fast as the operator could crank the table. Finish was very good, and the chips really flew—until the piece itself flew too. Then they decided it wasn't too safe. But the machine showed no strain and cutters held up well, even though the spindle travels at 3700 rpm, so the cutting speed was 6300 sfpm.

Super Salesman

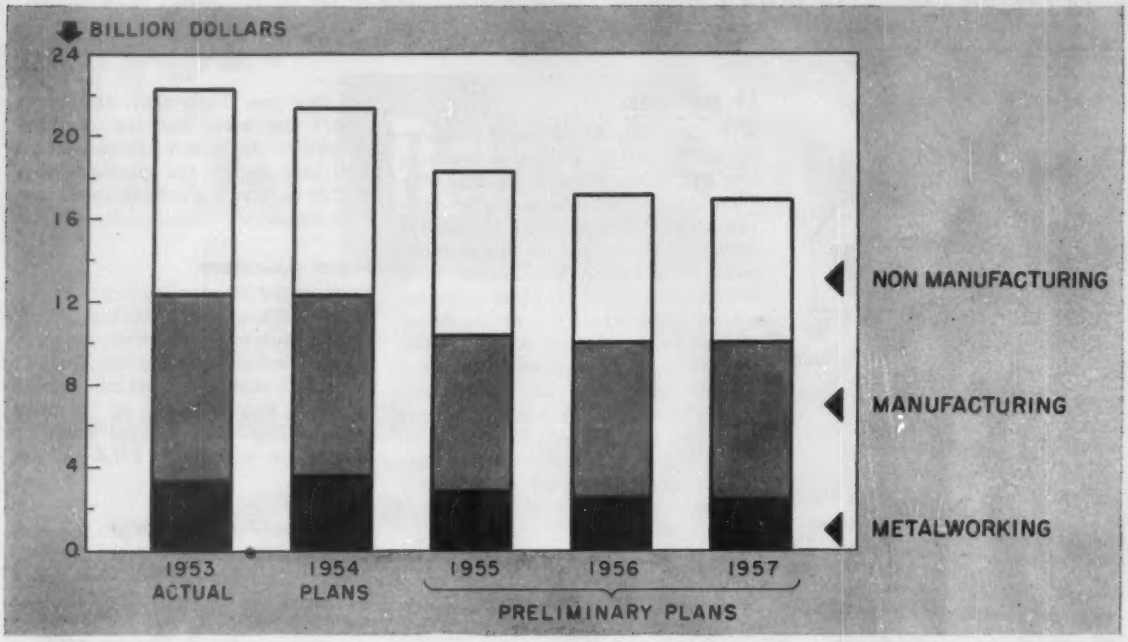
TALK ABOUT SELLING ice boxes to Eskimos! What about selling labor-saving equipment to a prison governor? An English company has just sold a fully automatic machine to the Ontario Reformatory, at Mimico, Canada. But that's not the whole of it. It's an automatic FILE-making machine.

One Dozen—Extra Large

LARGEST PIECES of roll-tapered wing skin yet produced have been made by Alcoa in its Davenport, Ia, plant for Douglas' Long Beach Div. Each wing uses 12 sheets 44x566 in. (roughly 4x47 ft) with thickness tapered from 0.151 to 0.269 in. Special slings and skids had to be developed for handling and heat-treating the skins, which were too long for any available sheet furnaces.

1950 Aerator

KITCHEN-FAUCET AERATORS applied to cutting-fluid lines are the subject of a major article in *AM* for April 12. The story gives detailed results at Caterpillar Tractor, and we kept the secret for a long, long time—until Caterpillar gave us the go-ahead. We've heard of it in use elsewhere, but as a closely guarded "trade secret." Now we find that we originally described the idea May 1, 1950, in a "Practical Idea" by John P Uetz of Philadelphia on page 103. Just goes to show the advantages of reading *AM* closely, even if you edit the magazine.



METALWORKING INDUSTRY'S CAPITAL SPENDING PLANS 1953-1957

METALWORKING's 1954 OUTLOOK: 10%

Metalworking companies are taking the long view on plant and equipment expansion, planning to increase capacity 6% this year in the face of declining sales. And they'll maintain 1950-53's high levels of capital spending through the next three years, a McGraw-Hill survey reports

NEW YORK—Metalworking plans to spend about $3.6 billion in 1954—10% more dollarwise, and 6% more capacity-wise than it spent in 1953. And over the long run (1955-57), metalworking has plans to spend an average of $2.6 billion or more a year for new plant and equipment, a new McGraw-Hill survey of capital spending plans shows.

Metalworking, the survey reveals, is one of the few industries to expand capacity in the face of declining sales (metalworking's anticipated 1954 sales decline is 3%). Most industries, such as mining, electric and gas utilities, railroads and other transportation and communication industries plan to spend about 4% less this year than last year. But preliminary plans for all industry show that total capital spending for 1955-1957 will be well within $2 billion of the very high average established in 1950-1953.

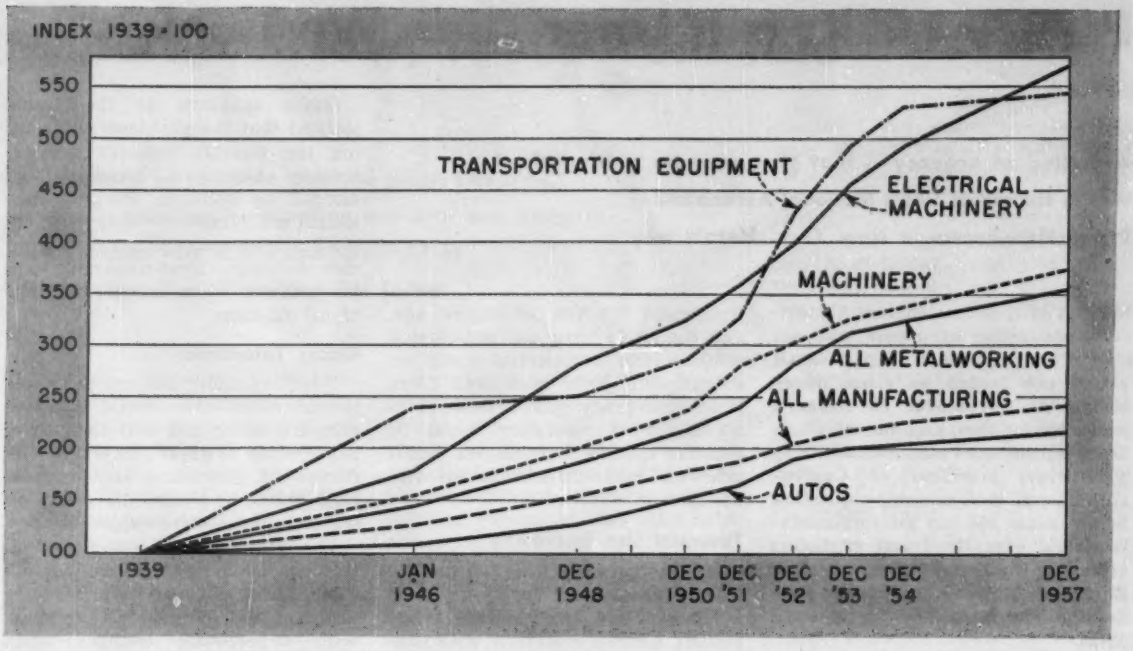
Industry's plans are geared to rising sales over the long term. But these plans also portend increasingly severe competition. On an average, manufacturers anticipate individual company sales for the period 1953-1957 to grow three times as fast as overall industry sales.

In achieving the expected $3.6 billion plant and equipment spending by metalworking in 1953, lion's share will fall to the auto makers, who plan a 29% increase in capital spending over 1953. Other segments of metalworking to increase their expenditures are electrical machinery and machinery companies. But transportation equipment and some other metalworking companies plan to spend less for new plant and equipment than they did last year. This is also true of the majority of manufacturing industries. Of non-metalworking industries, only petroleum and foods plan to increase their spending in 1954.

Plans Changed Since Fall

The high level of capital expenditures now planned by manufacturers represents a shift in plans since last fall. At that time manufacturers who cooperated in McGraw-Hill's preliminary survey of investment plans reported that their expenditures would decline 8% by 1954. But since then, almost every major manufacturing industry has reported planned spending increases. The shift is most striking in the case of machinery and automobile companies.

Replies to McGraw-Hill's current



METALWORKING CAPACITY WILL BE 3½ TIMES 1939's LEVEL BY THE END OF 1957

More Capital Spending, 3% Less Sales

survey show that large companies plan to spend proportionately more on plant and equipment than do small companies this year. In fact, most small companies are cutting back on capital spending.

$2.6 Billion a Year for 1955-57

Over the longer run, 1955-1957, metalworking alone has preliminary plans to spend an average $2.6 billion a year for new plant and equipment. And actual spending may be substantially higher than current estimates for those years. Experience indicates that business men usually underestimate their capital expenditures for periods longer than one year.

Industry as a whole plans to spend an average of $17.5 billion in the 1955-1957 period. Two manufacturing industries, chemicals and textiles, already plan to spend more for new plant and equipment in 1957 than they expect to spend this year. Railroads and petroleum refineries also plan 1957 capital spending at near-1954 levels.

Metalworking, which plans to increase capacity 6% this year and another 9% by 1957's end, will thus expand at a rate somewhat below that recorded in recent years. Electrical machinery plans the largest expansion in the 1954-1957 period, with aircraft and other transportation equipment firms maintaining a high expansion rate in 1954, but a lower rate thereafter.

Capacity Up 4% in '54

Productive capacity of all manufacturing will increase 4% in 1954 (against a 7% increase in 1953, 9% in 1952). Only three major industries—steel, petroleum refining and transportation equipment—plan to expand capacity in 1954-1957 at a rate markedly slower than that for all manufacturing, the survey shows.

Civilian Goods Industries Expand

Most rapidly expanding companies are those with new consumer products, such as electric appliances—or firms making new types of machinery for output of civilian goods. Chemicals are continuing their long-term growth.

By contrast, some of the industries that grew fastest during the 1951-1953 defense buildup are now cutting back fastest on capital spending. For example, the steel industry, which just about completed its big expansion program in 1953, from here on out expects to grow at a rate only one-fourth that of all manufacturing. And aircraft companies expect a relatively small increase in capacity from 1954's end through 1957.

Why More Spending?

Why is it that business continues to spend heavily for capital equipment when sales are declining? The answer seems to be that businessmen are looking beyond the current sales drop toward a brighter future. As a group, manufacturers expect a 2% drop in sales this year. But by 1957, the average manufacturing company looks forward to a sales increase of 12% over the 1953 level.

Individual companies expect to grab off a bigger share of the market. This means increased expansion to meet an era of tough competition.

PLANE TALK: Is It Later Than We Think?

A feeling of urgency — that time may be getting short — was in the air at SAE's National Aeronautic Production Forum in New York. Here's why . . .

NEW YORK — Can current US aircraft production keep pace with design changes when our aircraft plants are loaded with machinery bought in World War II, designed years before that, and not of much use or suited to jet manufacture? Roy T Hurley, president of Curtiss-Wright, put that searching question before some 800 top aircraft manufacturing executives and engineers attending the Society of Automotive Engineers' National Aeronautic Production Forum in New York April 12-15.

And the answer lies in cold statistics—in Curtiss-Wright alone, 5300 of its 6800 machines are old timers. And that's typical of the entire aircraft industry, he says.

Depreciation

But if accelerated depreciation is approved by Congress, Mr Hurley estimates that Curtiss-Wright will spend $10 million annually for new equipment. Needs for 10 years ahead have been studied—and the picture is fairly accurate for the first five: by getting the right equipment for close-tolerance thin material, and by applying automation to load and unload but not connect machines, savings in cost would soon pay for Curtiss-Wright's investment.

Plant Dispersal

Right now, said Mr Hurley, American production capacity and its dispersal are superior to Russia's, but the latter is coming along fast. Two well-placed bombs might be a "major victory," but the subcontracting system used by US companies now seems to be a more potent defense measure than the dispersion scheme highly touted until the hydrogen bomb came along.

Our chief danger lies in not being ready with modern plants—and here the government will probably have to put up money—according to Mr Hurley. He would like to set up his own concern with modern equipment for the jet-engine age, and tooled to turn out anticipated military and commercial needs on a single-shift, 40-hr week basis. Then, if an emergency comes, three-shift, six-day week operation could be attained quickly without the headaches and makeshifts connected with the Korean affair.

Titanium Use Increasing

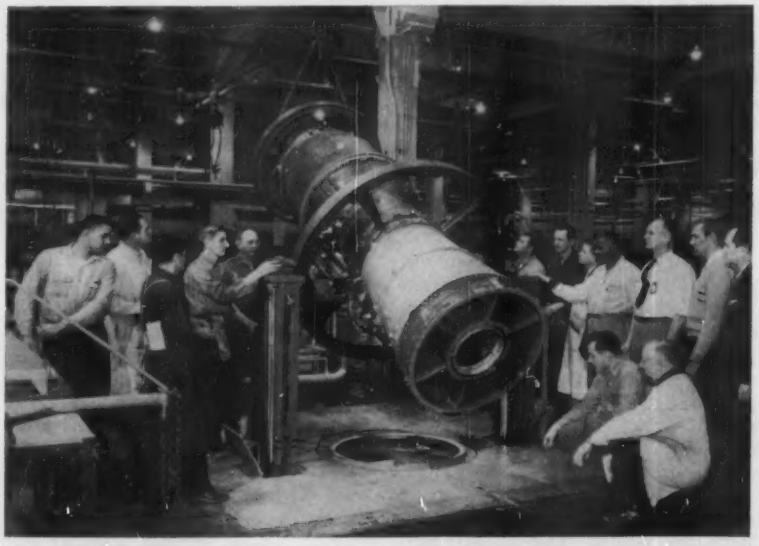
On the materials question in time of emergency, Mr Hurley let drop a few pointers. His company is replacing alloyed materials with titanium as rapidly as possible. Nickel is seen as the bad actor next time. Cobalt and chromium are being saved by substitution of titanium. And even plastic blading is being tried.

Other speakers at the forum showed that the problems confronting the aircraft industry are extremely numerous, complex, and difficult of solution. Forging men sought answers to cleaning methods, stock allowances, and press vs hammer forgings. Heat-treatment was the subject of a lively exchange of information.

Closer Tolerances

Unprecedented demand for close tolerances in sheet-metal parts of ever-increasing size and complexity is currently of great concern to producers of airframes and engines. New chemical treatments and plating techniques were explored.

The problem of production control has been met by methods for rapid statistical analysis and record keeping. And the problem of coping with engineering changes again cropped up. Two basic types of change must be considered: "at once," or "as soon as possible." Again, it was said that with good and suitable equipment at hand, the severity of the problem can be reduced.



Turbojet Manufacture at Ford Chicago

COMPLETED J-57 TURBOJET is taken out of construction well at Ford Aircraft Engine Division, Chicago, prior to be lowered onto special cradle for transport to test cell for checkout. Construction well is really an elevator that positions engine sections for assembly. Hydraulic lifts sink into floor when the well is not in use. Photo was taken during recent press open house

Modernize Now, Tool Forum Told

Replacement of obsolete machine tools, shielding, competitive selling, automation and new machining developments hold discussion spotlight at 18th Machine Tool Electrification Forum

BUFFALO — The nation's industrial swing back from emergency to competition, and the development of new machine tools to meet metalworking's changing picture, keynoted the 18th Machine Tool Electrification Forum here April 6-7.

Cites Machine Tool Goals

Luncheon speaker Herbert L Tigges, president National Machine Tool Builders' Association and executive vice president, Baker Brothers, Inc, told the 450 industrialists present that today's goals are reduction of costs, increased productivity and improved machine tools. Mr Tigges cited these trends as current in machine tools:

- **Advances in automatic operation.**
- **Faster tool-cutting motions.**
- **Development of automatic machinery.**
- **More rugged construction.**
- **Advances in electronic controls.**
- **Better work-holding devices.**
- **Faster loading and unloading.**

Urges Replacement

Forum lead-off speaker Tell Berna, general manager, NMTBA, said it would take the US machine tool industry four years of highest capacity output to replace the machine tools in US metalworking plants that are 20 years or more old. It is up to the machine tool industry, he continued, to persuade metalworking executives that plant modernization is in their best interest.

Machine-Tool Shielding

Mr Berna went on to discuss shielding of machine tools against radiation that might interfere with radar signals. Specifications are now being written into defense contracts that might appear unnecessarily stringent when the machine tools involved are to be installed in manufacturing areas where there are many unshielded machine tools, fluorescent lights, etc, that haven't yet interfered with radar signals, Mr Berna said. And, he addded, shielding is an expensive process that can run as much as 10% of machine cost.

Automotive Automation

An important feature of this year's Forum was a panel discussion of future needs of automotive industry automatic production lines. Requirements of the automotive industry were presented by G P Kreig, master mechanic, Packard Motor Co; W B Shimer, master mechanic, DeSoto Div, Chrysler Corp; R W Kowitz, engineering dept, Ford Motor Co; and A P O'Neill, asst plant engr, Pontiac Div, GM.

The problems involved in meeting these needs were then discussed by E E Opel of National Automatic Tools Co, R N Johnson of W F & John Barnes Co, Dr A O Schmidt of Kearney & Trecker Corp, and T W Bannon of Clearing Machine Corp.

Packaged Units

Salient point in the discussion was brought out by G P Kreig, of Packard Motor Co, who said in Packard's opinion "the machine tool builder's responsibility is to provide the basic mechanism for loading, positioning and unloading the parts; automatic gaging, where required; and a method of control that will automatically signal and shut down the operation when out of tolerance."

"We believe," he added, "that this should be provided as a package unit; and that the units should be arranged to provide easy accessibility for repair, tool changes and positioning controls."

Electrospark Machining

Electrospark machining was discussed by C Paul Porterfield of Method X Co, who said his company is exploring possible applications ranging from machining of high

TOP METALWORKING EXECUTIVES attending the Machine Tool Electrification Forum included (left), from left, Westinghouse's Ton Turner and George P Longabauch, who welcomed James D Allan of Pratt & Whitney. Right: Tell Berna, general manager, and Herbert L Tigges, president, National Machine Tool Builders' Association were keynote speakers at the Forum. Both speakers stressed the need for metalworking plant modernization.

Tool Forum
(continued)

temperature alloys for jet turbines to cutoff and hole drilling of steel rails.

Electrolytic Grinding

George Comstock, Norton Co, told of the work his organization is doing in the field of electrolytic grinding of carbide-tipped tools. Some former difficulties have been overcome, he said, by using a constant-voltage, current-limiting circuit involving a two-stage magnetic-amplifier-controlled power supply. It looks now as though electrolytic grinding won't come into its own until a shortage of diamond bort develops, Mr Comstock said, but then electrolytic grinding will stretch the supply 1-10 times.

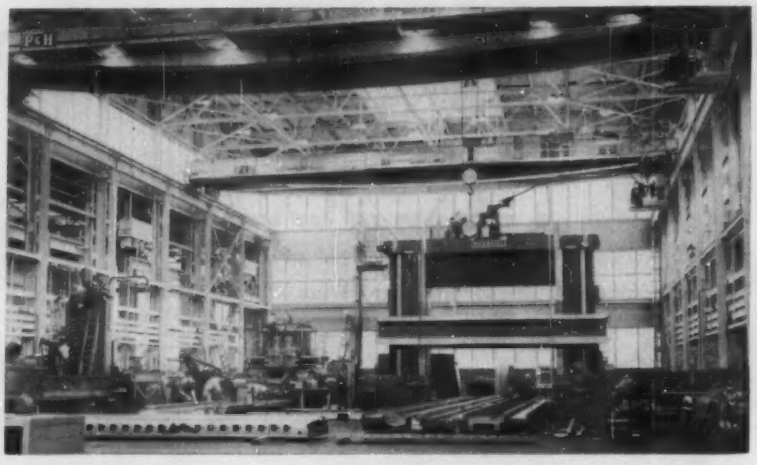
Coupling Lathes

R J Peck of Seneca Falls Machine Co described the coupling together of a pair of standard Lo-Swing automatic lathes with automation devices for turning, squaring and chamfering seven diameters on 112 camshafts per hour. The setup (see *AM*—Mar 29 '54, p110 for details) includes automatic gaging heads and a conveyor system.

Turret Positioning

Walton Rainey of Wiedemann Machine Co described a simplified servo system for automatic turret positioning. This system was applied to a Wiedemann 80-ton turret punch press with a 60 x 120-in. compound gaging table. An automatic machine for Microhoning the bores of gear blanks was described in a paper presented by E L Behringer of Micromatic Hone Co. It incorporates automatic feeding and gaging devices, as well as means for terminating the honing cycle by measurement of the bore as honing progresses. Harlan E Grimes of The Avey Drilling Machine Co described a novel, inexpensive electrical circuit developed for precision checking of indexing movements of machine tools.

Papers discussing developments in the electrical field were presented by W H Formhals, C G Helmick, Dr R L Bright, D C Russ Jr, and H W Jones of Westinghouse. General chairman of the forum was W B Weathers, manager, Machinery Electrification Sales, Industrial Dept, Westinghouse Electric Corp.



NEW ERECTING ROOM is five stories high, is underlaid with reinforced concrete floor 18 to 36 ft thick to prevent floor sag

THE TREND: Big

That's the story at Ingersoll Milling Machine Co, where new buildings and giant machine tools are ready to meet today's trend toward bigger and bigger tools for the metalworking industry

ROCKFORD, ILL — A four-way $3 million expansion program to meet the growing needs of the metalworking industry has been completed here after two years by the Ingersoll Milling Machine Co.

Ingersoll's plant expansion program is built around three featured additions:

- A 100 x 300-ft erecting room, with 40-ft under the hooks of two 40-ton cranes, and with two large pits for assembling machines with sections extending below floor level.
- A 575-ton, 870-hp Ingersoll adjustable rail milling machine.
- A large engineering room addition.

Less tangible but still a major feature of Ingersoll's expansion is the modernization and repainting of the company's machine shop to the extent that average age of all machine tools in the plant is now 6½ years.

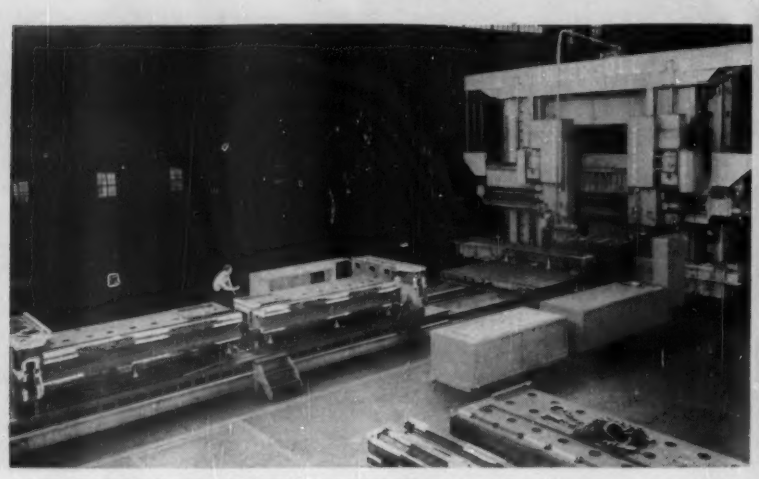
Ingersoll's new adjustable rail milling machine, specially designed for Ingersoll's own use, has a finished weight of 1.5 million lb. contrasted with a machine of similar dimensions built by Ingersoll 22 years ago that weighs only 500,000 lb.

One head is powered by a 250-hp drive motor. The other three motor driven heads are powered by 150 hp each. And the machine is so designed that up to 400 hp can be put through the large head for periods up to 3 min. Thus, combined horsepower of all four motors is 870.

Split Worktable

Split worktable is so designed as to be used as one 62-ft table, or as separate 27-ft and 35-ft tables. One can be parked for loading and unloading while the other is cutting. When long jobs are to be machined, the half tables are combined for use as a single unit.

Almost complete pendant control permits fast action and easy operation, in spite of the machine's size. Power shank rods are used for fast changeover of cutters, and all vertical heads, and spindle gear changes are power operated and controlled



ADJUSTABLE RAIL MILLING MACHINE weighs 1.5-million lb, has worktable that can be split into 27 and 35-ft tables or used as 62-ft unit

MAN EXAMINING HEAD indicates huge size of milling machine

Machines to Make Bigger Machines

from the pendant. Power-operated rail clamps and quill locks are push-button controlled. A separate feed control is provided for the table, horizontal heads and cross rail, and vertical heads.

Chips from machine drop into trough in floor along each side of table, are then moved by Hapman conveyor to discharge point outside building, 100 feet away. This conveyor is used only for cast-iron chips. For the few steel jobs milled on this machine, chips are trucked to outdoor bins.

Ingersoll's new adjustable rail milling machine is designed not only to meet future production requirements, but for research and development work.

"Experimental efforts to determine the full potential of carbide milling cutters have been unsuccessful during the last 10 years because no previous machine had the weight and ridigity required for such tests," say Ingersoll officials. Ingersoll now thinks it has the answer in its new milling machine which doesn't "breathe" while the cutters are at work, allowing for more accurate tests of tool life and metal removal capacity. In this way, the company will be able to experiment with new designs and blade materials, and with milling of new materials.

Ingersoll's new erecting room is a five-story-high structure of aluminum-painted corrugated metal siding and blue-tinted glass, has plenty of room to handle heavy castings. Entire floor is of reinforced concrete from 18 to 36-in. thick to prevent floor sag and to simulate test conditions like permanent installations in customers' plants. The result: a saving of both original assembly and on installation time at Ingersoll.

Adjacent to the erecting room is a new storage area for machined parts awaiting assembly. This room also provides space for electricians and storage for electric components.

Two railroad tracks serving both the new and old erecting rooms enter the building through new train sheds. Double overhead doors cut heat losses in the building when trains go in or out. Increased trackage inside the building speeds up loading of machines.

Engineering Dept Modernized

Ingersoll's increased shop capacity is matched with a 40% area increase in the engineering department, where each man now has his own partitioned-off work area. Bigger drawing boards, better working tools and 100-ft-candle-plus lighting are among other improvements in the department.

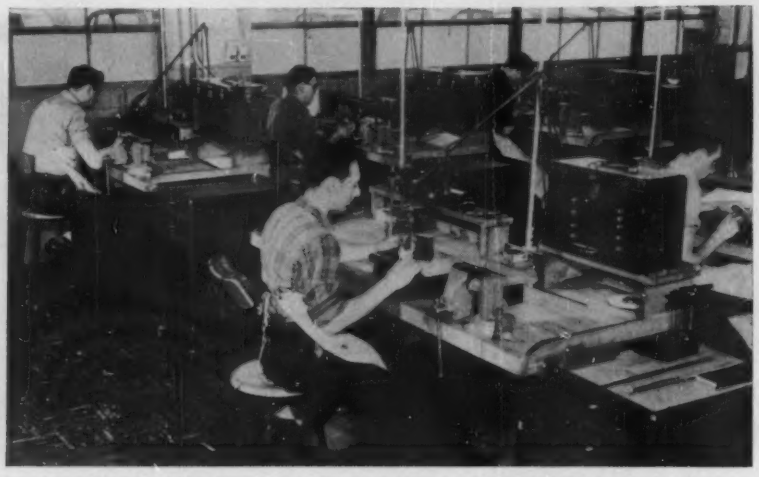
A CORRECTION

As a result of several requests for information on the possible effects of mist cooling on workers, we asked Dr Paul Kotin, of the Department of Pathology of the University of Southern California, for an opinion. This he graciously gave us in a letter. In initial editing of the letter, we failed to convey the impression that we had asked for the opinion. Dr Kotin asked revision to correct any possible misunderstanding of the reasons for his letter.

In our April 12th issue, both correct and incorrect versions were included, with the explanation and correct initial paragraph following the incorrect version.

Dr. Kotin has received a number of requests for further information, some of which indicate misunderstanding of his position in the matter. We are duly apologetic, and feel that it is only fair to the doctor to explain as promptly as possible that his letter was written at our request, and that it represents an opinion only. **The Editors.**

VETERAN DIEMAKER Francis Beck has a full-time job teaching apprentices



FINEST TOOL SHOP SETUP AND WORKING CONDITIONS are approximated in Volkert's apprentice school. Bench work comprises about half the training

APPRENTICES: Training 'Em Right

That's the policy at John Volkert Metal Stampings, which believes the best men are "home made," not pirated. This small plant (140 people) is sparing no effort to train the "finest tool and diemakers ever made for the precision work of the future."

QUEENS VILLAGE, NY — There is a growing awareness among metalworking executives, especially the members of the National Tool & Die Mfrs Assn, that skilled men must be created by bona-fide, up-to-date apprentice training programs rather than by picking them up by chance or the offer of the high dollar.

One of the leaders in this thinking is Jack Kleinoder, general manager of Volkert, chairman of the Apprenticeship Committee of the NTDMA. A trained diemaker himself, and one of the founders of a concern that is now a leading supplier of precision stampings to the electronics industry, he believes that even the small shop (his has 140 people, of which 50 are skilled) must now and henceforth develop trained tool and diemakers with the skills and knowledge to handle the precision jobs of the future. To do otherwise, he feels, is merely courting strangulation of the business for lack of skilled people, and at the very least an inability to compete for the profitable, high-class work.

From this background of thinking, Volkert launched last September one of the most carefully planned, practical and ambitious apprentice-training programs ever undertaken. The "school" is set up in a 2500-sq-ft section of a new building and is equipped with about $40,000 worth of machine tools (a jig borer is on order), the finest benches, tools, measuring devices, etc. Five young men are in training now, possibly two more will be added each year until the full quota of twelve is achieved. The plan is to graduate three men a year.

Extensive Screening

Applicants are weeded out by tool and diemaker aptitude tests of the US Employment Service, personal interviews, qualification tests, physical examinations, and finally by aptitude tests given by an independent research organization. Successful applicants start employment on a 90-day probation.

The school is not an "isolation ward." For the first three years, the apprentices do work in the school and in the shop itself under the direction of a full-time instructor who has had 40 years of diemaking and supervisory experience. He rates each boy daily by job and job quality, and records the time spent monthly on each type of machine. The fourth year is spent in the toolroom.

Productive Output

All work done is for parts that will go into actual tools. The instructor serves as job leader, he knows how to teach, and he has the time to provide close supervision and instruction — in contrast to the common system of a journeyman trying to impart training while under the stress of meeting delivery schedules.

The 8000-hr shop training conforms with requirements of the New York State Apprenticeship Council and the NTDMA. In addition, 218 hr of related training is given in evening courses by Pratt Institute instructors, according to a program approved by the New York City Board of Education.

Cost: $6000-7500 Per Man

Mr Kleinoder estimates that the cost of training apprentices will lie between $6000 to $7500 each, but is not worried about losing trained men, and feels that he will have the nucleus of skill for any future requirements.

A H d'Arcambal

L B Neumiller

H E Martin

Names in the News . . .

Alexander H d'Arcambal has been elected president of Niles-Bement-Pond Co, West Hartford, Conn, succeeding the late Frederick W Conard. **Charles W Deeds,** president from 1943 to 1947, has become chairman of the board, and **Richard W Banfield** executive vice president. N-B-P includes Pratt & Whitney's Machine Tools Div and Cutting Tool & Gage Div, Chandler-Evans Div, and Potter & Johnston Co. Associated with N-B-P for 35 years, Mr d'Arcambal started as a metallurgist, and in 1927 became manager Cutting Tool & Gage Div. In 1941 he was elected vice president and in addition was made general sales manager in 1950. He had been acting general manager since Mr Conard's death March 14. He is a past national president of the American Society for Metals. Mr Banfield joined N-B-P as a special apprentice in 1935 and was appointed secretary in 1943. He became secretary-treasurer in 1945 and last year he was named vice president and subsequently manager of the Cutting Tool & Gage Division.

Louis B Neumiller, for 12 years president of Caterpillar Tractor Co, Peoria, Ill, has been elected chairman of the board. He is succeeded as president by **Harmon S Eberhard,** executive vice president of Caterpillar since 1950.

Harold E Martin has been named division superintendent of Brown & Sharpe Mfg Co's newly created Metal Cutting Tool Div. He will be in full charge of the present cutter manufacturing, hardening, and engineering departments, as well as the cutter office.

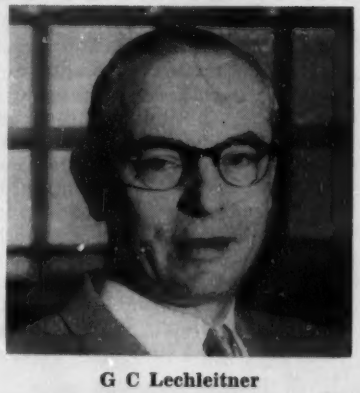
Jack F Anschuetz has been appointed assistant sales manager of Clearing Machine Corp. He will be responsible for sales of open back inclinable presses and other press equipment now being manufactured at the plant in Hamilton, Ohio.

Glenn C Lechleitner, formerly sales manager, has been named general manager of Cleveland Punch & Shear Works, Cleveland. He was formerly sales engineer and sales manager.

N Fodor, executive vice president and general manager of Micro-Precision Inc, will direct all operations at the company's new 40,000-sq-ft plant recently opened in Evanston, Ill.

Wesley R Johnson has been named eastern district manager of Illinois Tool Works' Shakeproof Div, Elgin, Ill, **Robert S Carroll,** formerly sales promotion manager, succeeds Mr Johnson as sales representative for the New York area.

J F Anschuetz

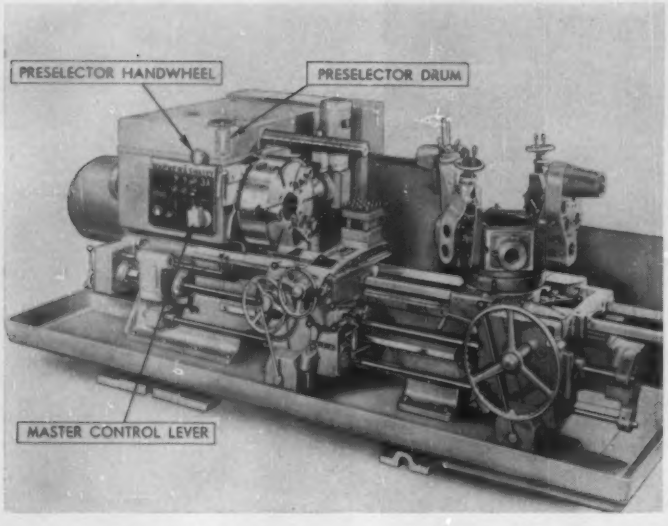


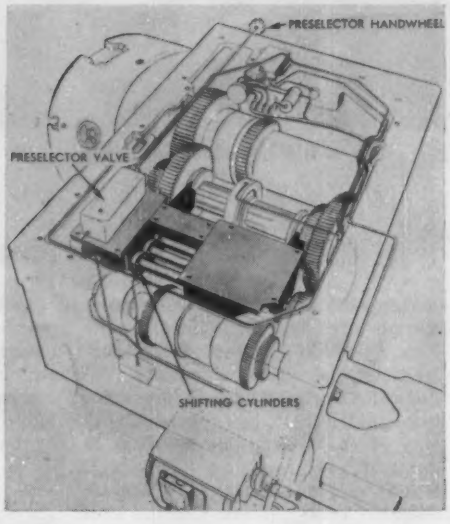
G C Lechleitner

N Fodor

W R Johnson

New Shop Equipment,





First of Four New Warner & Swasey Lathes

This Model 3A heavy-duty turret lathe is the first of four recently announced new models of heavy-duty saddle-type turret lathes to come off the assembly line. Machine has greater power to permit users to take full advantage of future improvements in tooling, cutter design, and cutter materials; more speeds with smaller increments enable a greater range of work diameters to be machined at ideal cutting speeds; and automatic hydraulic gear shifting reduces handling time and operator fatigue.

It is available with either 4½- or 6-in. round bar capacity and the effective swing is 23½ in. The 4½-in.-capacity spindle has an 11-in. American Standard flanged nose and the 6-in.-capacity spindle has 15-in. nose.

CONSTRUCTION

The headstock incorporates a 16-speed hydraulic-shift preselector head. Four speeds have been added to give a speed range of 35½ to 1. With a two-speed motor, 32 unduplicated speeds can be preselected, ranging from 12 to 851 rpm. Available maximum hp has been increased 50% and top speed 35%.

The headstock has disk-type hydraulic clutches for forward, reverse, and brake action with reverse speeds exactly equal to forward speeds. The master control lever has four positions: forward, neutral, brake, and reverse, plus an "in" shift position. Shifting of gears is done hydraulically and automatically in a matter of seconds by four hydraulic cylinders in the headstock (see diagram above). The preselector valve sets up the cylinder combination that will effect the speed desired.

OPERATION

After the operator has set the required speed and pushed the master control lever, the headstock gear train is slowed to crawl speed by braking action of the crawl clutch; hydraulic pressure is directed to proper shift cylinders as determined by preselector valve, and shifting of gears is accomplished hydraulically. After the shift, master control lever automatically snaps "out" to normal run position and spindle revolves at new preselected speed.

In addition to the preselector control knob and drum dial, the control panel contains high-low motor-start buttons, a motor-stop button, a chuck-wrench external-internal selector switch, oil-pressure gage and spindle-inching button. Lever to the right of panel controls functions of power chuck wrench.

Cross-slide and hexagon turret are equipped with rapid traverse units of new design, reported to require less operator effort. Power rapid traverse on cross-slide provides both longitudinal and transverse movement.

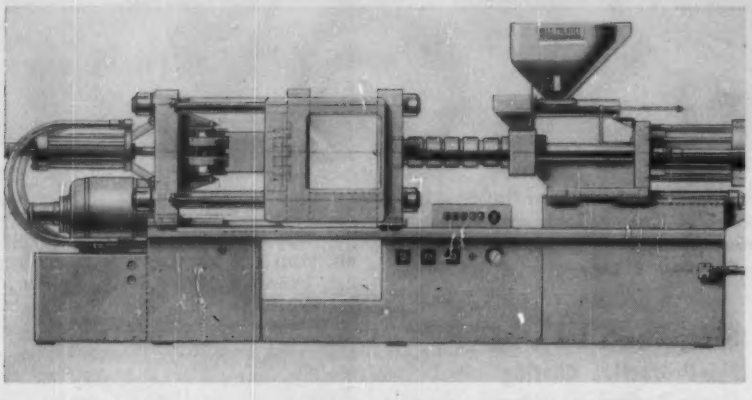
Head-end gearboxes have been redesigned to incorporate anti-friction bearings with automatic oil supply. Beds, saddles, carriages, and aprons are designed to provide rigidity, strength, and accuracy compatible with increase in horsepower and speeds.

FUTURE MODELS

The features of the 3A will be incorporated in the 2A (smaller) and 4A machines coming off the line later this year. The fourth new machine, the 1A, is a smaller size of saddle-type turret lathe, similar to the others with the exception that the spindle and all shafts in its power train will be equipped with hydraulic clutches and constantly meshed gears.

Warner & Swasey Co, 5701 Carnegie Ave, Cleveland, Ohio

Materials and Parts . . .



Plastic-Injection-Molding Machine Offers Faster Cycles, Larger Capacity

Reed - Prentice Model 300T - 12/16 plastic - injection - molding machine has a 10-sec cycle which boosts molding speed to 360 shots per hr. In actual production a stuffing arrangement permits shots of 16 oz or more through multiple stroke.

Newly-designed heating cylinder plasticizes up to 115 lb of thermoplastic material per hour. The heater has ceramic heating elements and is constructed with simplified design.

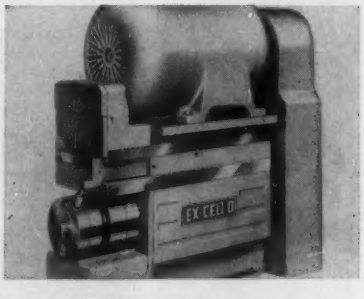
Four tie bars of 4-in. dia form a frame for the mold platens and double shear-link mechanism which develops 300 tons positive mechanical clamping pressure. An adjustment in the link provides mold-clamping-stroke adjustment from 7½ to 12½ in.

Mold platens measure 29x32½ in. and will accommodate molds as large as 29x20½ in. Rated projected casting area in the mold is 150 sq-in.

Central pushbutton station controls movement of die plate and plunger, mold adjustment, and heating cylinder adjustment. New feed hopper adds operating convenience by accommodating standard 200-lb material drum on a 45° angle.

Automatic weigh-feed mechanism can be furnished to produce parts of accurate weight and avoid overpacking. A low-pressure die-closing attachment is also available to provide safe, fully automatic molding cycles. This controlled pressure unit prevents damage to molds by instantly stopping the machine if a piece of plastic fails to eject automatically.

Reed-Prentice Corp, Worcester 4, Mass



Hydraulic Power Unit Is Self-Contained

Ex-Cell-O quill-type hydraulic power unit, Style 22, is a self-contained, compact, hydraulically operated unit designed for actuating single tool or multiple spindle head in controlled automatic cycles. It has an 8-in. stroke and a companion unit, Style 22-L, has a 12-in. stroke.

Cycle, initiated electrically or manually, includes rapid approach, first, second feeds, reverse, return, stop.

Ex-Cell-O Corp, 400 Oakland Blvd, Detroit 32, Mich

. . . INCLUDING

Production surface grinder has table speed variable to 150 fpm and 6000-sfpm speed with 20-in. wheel . . . . . page 160

Automatic size control for cylindrical grinders is capable of maintaining 0.00005-in. accuracy page 161

Multiple nut setter sets from two to five nuts simultaneously, each to different torque . . . . page 164

Automatic parts washer has three compartments, each a complete tank with separate controls page 166

Dividing head adjusts from horizontal to vertical, rotates 360°, and has fine rotary setting in minutes . . . . . page 168

Stretch-forming press, for magnesium aircraft parts, uses sheet-steel shell die and thermostatically controlled heat . . . . . page 170

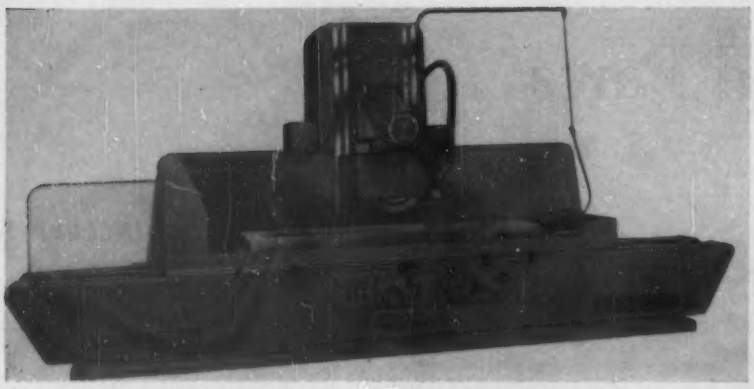
Extrusion process produces ordnance shells in one piece from simple billet . . . . . page 172

Portable profile projector uses 7⅞-in. screen, inspects surface and gages silhouette of small parts page 174

. . . and in May 10

Hydraulic press produces single, solid pieces of cermented carbide as heavy as 4000 lb.

Vertical surface grinder has hydraulically controlled table with speed infinitely variable to 100 fpm.



PRODUCTION SURFACE GRINDER with hydraulic feed and cross traveling head is 24x25x96 in. Speed with 20-in.-dia wheel is 6000 sfpm. Table speed varies up to 150 fpm, actuated through Vickers tandem pump. Self-contained motor-driven coolant system is standard equipment —*Gallmeyer & Livingston Co, 346 Straight Ave, Grand Rapids, Mich*

Dyna-Trol Furnace Offers High-Stability Heat

Dyna-Trol industrial electric furnaces, rated up to 2000 and 2300 F will reportedly reproduce any time-temperature curve within ±3 F. Line consists of over 40 standard models with special models available. The furnaces offer infinite zone control by means of input controllers which control from 8 to 100% of input. This allows for complete and accurate equalization of vertical zone temperatures at any time-temperature curve. Once the furnace has reached the desired temperature level (between 500 and 2300 F) it can be maintained to ±3 F. Compensation for voltage fluctuation is automatic.

Dyna-Trol automatic furnaces are equipped with a Cyber-Tac temperature controller to indicate temperatures, to hold temperatures, or to cut off temperatures. It will hold or cut off temperatures to ±2% of full scale temperature reading.

Additional information is contained in manufacturer's bulletin 12-53.

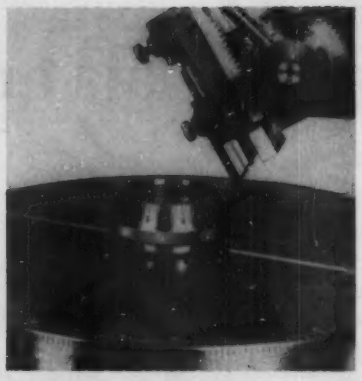
L and L Mfg Co, Chester 29, Pa

Underwriter's Lab Lists Fire-Protective Coating

Mastic 80, fire-resistive, weather-protective coating, has been listed by Underwriter's Lab after tests involving the application of a ⅛-in. coating over steel and asbestos cement board. Resulting Fire Hazard Classification gives flame spread, fuel contributed, and smoke developed.

Applied by spray, glove, or trowel over large storage tanks, pipe lines, valves and fittings, Mastic is anti-corrodant, vapor-barrier, and arid weather-protective coating.

Benjamin Foster Co, 4635 W Girard Ave, Philadelphia 31, Pa

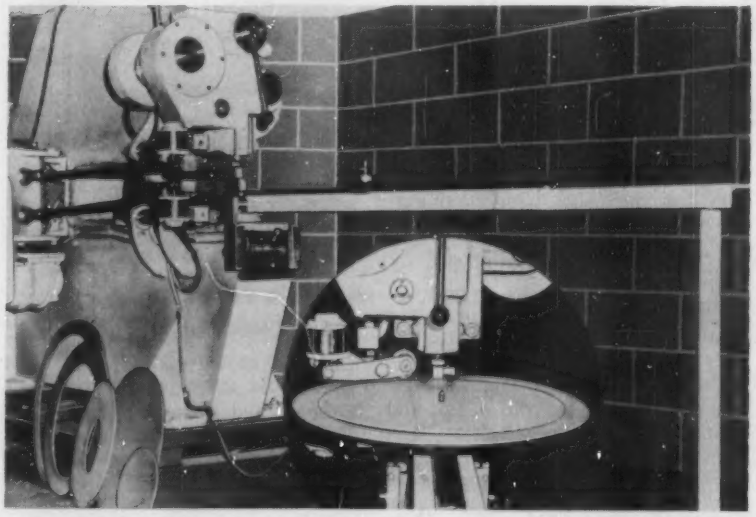


Circular Dividing Machine

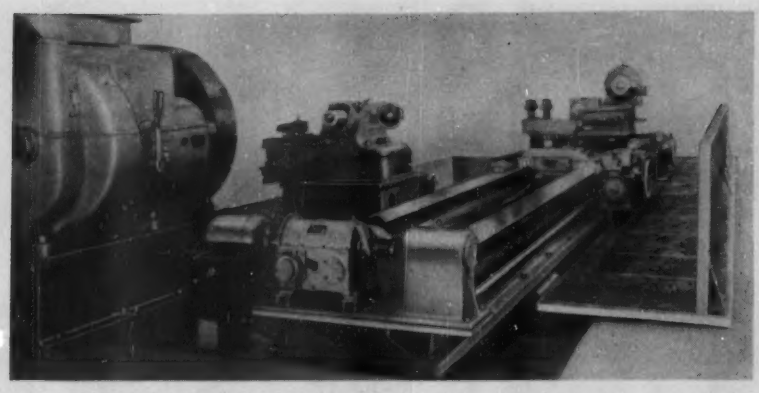
Abwood automatic circular dividing machine was designed for dividing flat, cylindrical, and tapered instrument, machine-tool, and fixture dials. Its precisely centered 20-in. table will support heavy work pieces, and accuracy is assured through master cams; gear trains are not used. Machine operates with automatic cycle and length of graduations can be quickly preset.

Another new Engis item is a matrix screen-reading dividing head which reads directly on a well-shielded screen to 12 seconds of arc, with estimations to 3 seconds. Operation is reported extremely fast, and head may be used for production in grinding and milling as well as for inspection.

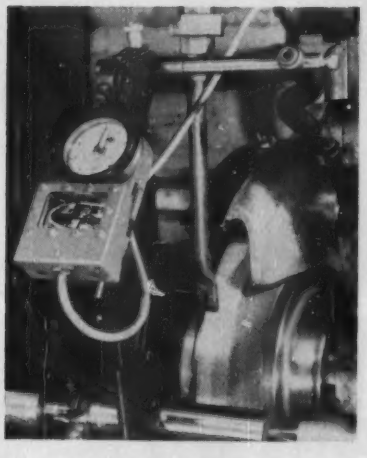
Engis Equipment Co, 310 S Michigan Ave, Chicago, Ill



OUTSIDE ATTACHMENT with sliding center increases radius capacity for cutting circles with American Pullmax sheet and plate-working machine. Before this development the diameter of circles was restricted to throat depth of machine. Attachment can be designed for different kinds of applications and made in different lengths. Used on larger-sized machines with power feed, it will increase working range considerably —*American Pullmax Co, Inc, 2455 N Sheffield Ave, Chicago 14, Ill*



MASSIVE PIT LATHE was designed and built by Simmons for the Lukens Steel Co. Lukens fabricated a 17-ton, 42-ft-long steel weldment for use as the bed. Simmons rough-ground, planed, and finished-ground the ways to 0.002-in. Machine can handle steam-jacketed dryer rolls of up to 14 ft in dia with 30 ft centers — *Simmons Machine Tool Corp, Albany, NY*



Automatic Size Control For Cylindrical Grinders

Federal Products electric grinding gage is made up of Arnold grinding gage frame and caliper with Federal electricator instead of regular dial indicator, plus a power or control unit.

Automatic control of grinder begins as soon as gage is snapped on work; Federal's gage can be placed on work at any time. Gage rides the work during grinding and through its power unit controls the wheelhead-feeding mechanism which runs at a rapid grinding rate until work diameter reaches between 0.0005 and 0.004 in. of final size.

At changeover point, wheel is switched by gage control to slow spark-out feed. Once final size is reached, wheel is automatically retracted. It is reported possible to maintain 0.00005-in. accuracy over a prolonged period of time. Design improvements include: splash-proof case which encloses both indicator movement and electric switching unit; limit-setting screws enclosed by shield which protects them from accidental turning; use of separate power unit which eliminates necessity for manually resetting gage after each work cycle.

Federal Products Corp, 1144 Eddy St, Providence 1, RI

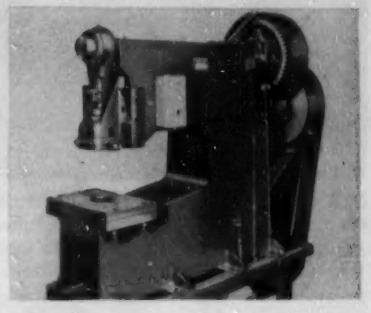
Timing Belt Drives Spindle of Wade Hand Screw Machine

Model 73 hand screw machine uses a timing belt to drive the headstock spindle. It is reported that this transmission drive will eliminate many of the problems common to most drives, and help in maintaining operating accuracy.

A mechanical reverse is said to give instant reversals without disturbing the continuous forward operation of the motor. Hardened and ground self-centering bed has two symmetrically beveled sides to assure balanced alignment of all attachments. The drive, completely inclosed in the pedestal cabinet, gives an infinitely variable speed with top of 3500 rpm, powered with a 1-hp motor. Instantaneous high-low speeds in a ratio of 5 to 1 are obtained through a clutch. A brake is provided for quickly stopping the headstock spindle.

The headstock, totally enclosed, has 1-in. collet capacity and is equipped with high-precision bearings. All bearings are under a slight preload to eliminate deflection and yield and assure an extremely rigid spindle for close tolerance work.

Wade Tool Co, Waltham, Mass



40-Ton Punch Press Added to Whitney Line

No. 331 40-ton deep-throat power punch press is a typical Whitney-Jensen construction with welded-steel frame, pancake-type motor, heavy flywheel and gearing located at rear of frame, rugged shaft and ram, non-repeat clutch, and heavy bolster plate. Supporting structure is mostly large angle iron, all-welded for strength and solidity. All suitable accessories are available.

Specifications include: depth of throat, 24 in.; height of throat, 12 in.; 84 spm; length of stroke, 2½ in.; maximum die space, 9 in.; bolster plate, 12x20x1½ in.; 3-hp motor.

Whitney Metal Tool Co, Rockford, Ill

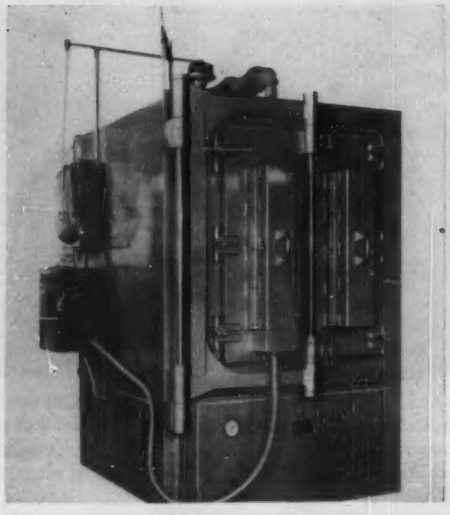
Rem-Cru All-Alpha Titanium-Base Alloy

A-110AT, a titanium-base alloy which is weldable and which has higher strength at temperatures above 900F, represents first commercial production of titanium alloy containing appreciable quantities of tin. This element improves hot workability of titanium-aluminum alloys and acts to broaden range of temperatures over which A-110 can be forged.

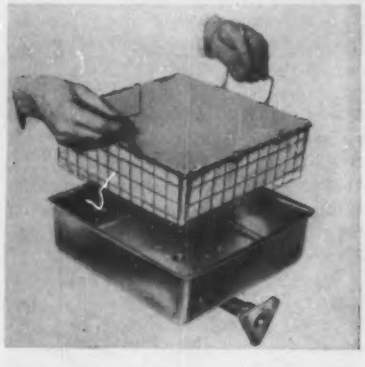
It is available in production quantities in the form of billets, bars, plate, and sheet in thicknesses over about 0.1 in. It is recommended for all welded applications requiring material with higher strength than is provided in RC-70.

Rem-Cru Titianium, Inc, Midland, Pa

DRAWER-TYPE OVEN preheats laminated phenolics prior to forming. Forced-convection design surrounds phenolics with uniform high-temperature air. Pushbutton controls close drawer and reset timer. Maximum temperature is 600 F and timer is set to limit soak period. Interior baffles make 5° temperature control possible. Drawer size is 54 x 48 x 6 in. Drawer is powered by air cylinder — *Coates Electric Mfg Co, 3419 11th Ave SW, Seattle 4, Wash*



ELECTRIC VACUUM FURNACE, high-temperature, is shown processing emery wheels. Vacuum of 29 in. and temperatures to 2300 F can be obtained. Huppert-type Kanthal rod elements are used. Burning chamber is 27 x 37 x 38 in. (wxhxd). It is available in other sizes — *K H Huppert Co, 6830 Cottage Grove Ave, Chicago 37, Ill*



Delpark Filter for Low Coolant Flow

The Delpark Junior, a positive-action filter for low coolant flow, is reported to offer greater saving in production time, more efficient machine operation, less downtime for tool correction and dressing for grinders. Continuous positive filtration removes abrasive solids from coolant as it comes from work.

The unit comes complete with combination mounting bracket and clean coolant return line or, if preferred, a connection is available for separate pipe or hose. Servicing is accomplished in a matter of seconds. Woven wire basket holds dispensable filter tray. When tray becomes filled with swarf it is easily removed and replaced.

Industrial Filtration Co, Dept 287, Lebanon, Ind

High-Low Temperature Webber Test Chamber

Webber chamber A-30-40FH was designed for large capacity testing at high and low temperatures. Unit has 30-cu-ft capacity.

Features include: visible-type controller; patented heat exchangers and multi-paned visual port and apertures for connections to inner chamber; stainless steel construction with superfine glass fiber insulation.

Temperature range is from –40 F to +200 F. Other units have ranges to –200 F.

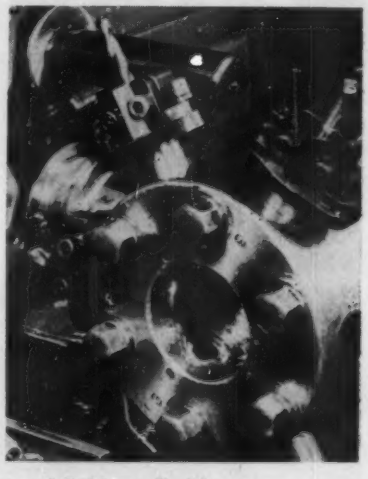
Webber Mfg Co, Inc, Dept 287, 2840 Madison Ave, Indianapolis 3, Ind

Skil Disk Sanders Have 4500-rpm Speed

Disk sanders, Model 851, standard-duty unit, and 852, heavy-duty unit, use a 7-in. disk and have a new front handle location to take the weight off the operator's hands. Shorter length and lighter weight have been incorporated to minimize fatigue and lower maintenance cost. Standard equipment includes 7-in. molded rubber backing pad, backing pad nut, flange for grinding wheel, three assorted sanding disks, detachable front handle for right- or left-hand use, tool rest, wrench, and 3-wire cord and connector.

Spindle diameter is ⅝ in.; motor is universal. No-load speed is 4500 rpm.

The Skil Corp, Chicago 11, Ill

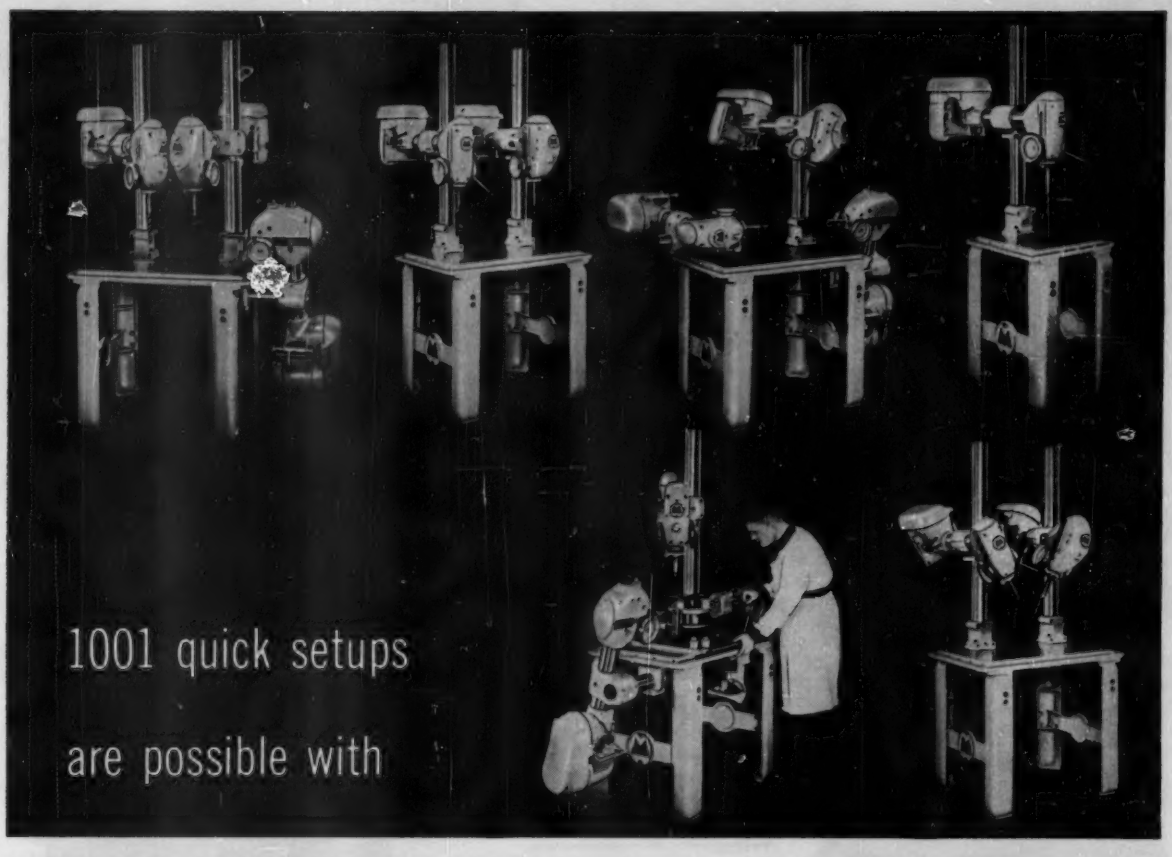


Brookfield Toolholder

Model BA-10 toolholder was designed specially for use on No. 00 B&S machines. Features include: smaller physical outline; 25% lighter weight; adjustable V-jaw feature which eliminates need for bushings and other holding accessories; V-jaw section and shank parallel within 0.005 in. in 6 in., run-out less than 0.0001 in. per inch; balanced-pressure locking assembly accomplished by spherical undersides of heads of locking screws and internally beveled washers.

Holding capacity is from 1/64 to 5/16 in.; shank diameter, ⅝ in.; shank length, 1⅛ in.

Brookfield, Inc, 172 Newbury St, Boston 16, Mass



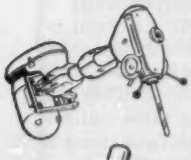
MAGNA DRILL

the universal drilling and tapping machine

We can show only six of them here, but the possibilities are almost unlimited. You can set up MAGNA DRILL to drill or tap many holes at the same time from any angle in any plane. And you can change from one setup to another quickly, without special tooling.

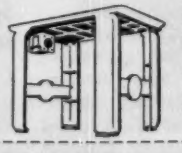
But the most surprising of all MAGNA DRILL features is its low cost. Check the prices listed on this page. To find out all about MAGNA DRILL, fill out and mail the coupon. *See it in action at booth 1834, ASTE Industrial Exposition, Philadelphia, April 26-30.*

MAGNA DRILL MODULAR COMPONENTS



DRILL HEADS Individually powered, adjustable heads can be indexed and locked at any angle or position without special tools. Variable throat. Right or left hand manual feed. Price less 1-hp. motor, $285*

POWER FEED (Mechanical Type) attaches to MAGNA DRILL head in a few minutes. Feed rates .003" to .012" per revolution. Solenoid engage. Spring return. Automatic cycling. $195*



TABLES AND LEGS Drilled and tapped for mounting head in variety of positions and for ganging tables in multiples. Single table, 24" x 20". $185*. Double table, 24" x 40". $235*

*Delivered to your plant

LEAD SCREW TAPPER Consists of lead screw and nut that quickly replace normal quill; limit switch control plate and complete reversing starter with all wiring and controls for drilling or tapping. $260*

COLUMNS AND BASES Tubes supporting drill heads are heavy 3/8" wall, 3 1/2" O. D., precision ground. Bases are line-bored cast iron; mount horizontally or vertically. $48*

MAGNA ENGINEERING CORPORATION
Dept. 264-L, at factory nearest you:
12819 Coit Rd., Cleveland 8, Ohio, OR Menlo Park, California

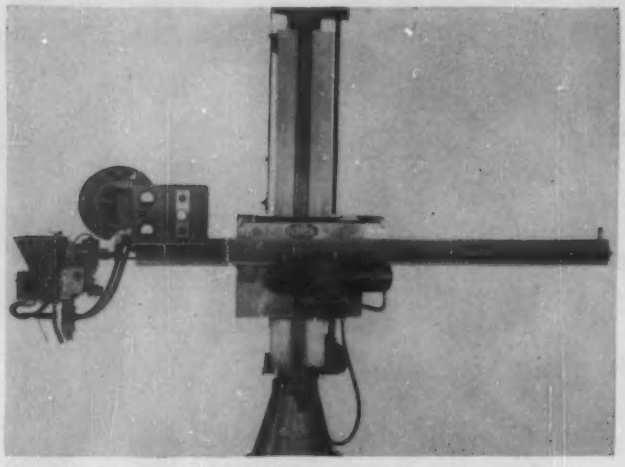
☐ Please send more information about MAGNA DRILL.
☐ Please have representative call.

Name _____

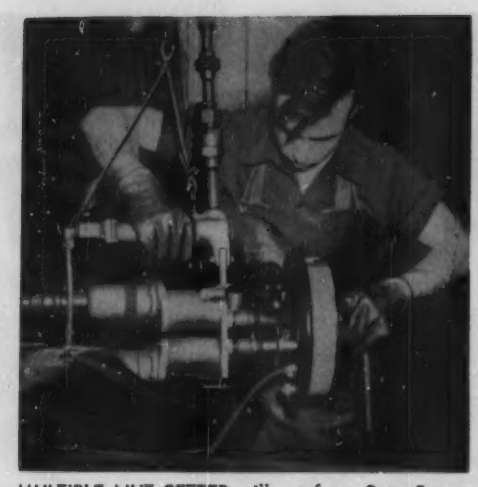
Position _____

Company _____

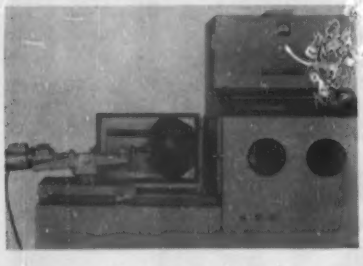
Address _____



AUTOMATIC WELDING FIXTURE may be mounted on a carriage to travel longitudinally on special track. Track sections are 10-ft lengths; track speed is variable from 0 to 100 ipm. The tubular lateral ram travels 6½ ft over positioned or rotating work. Motorized vertical adjustment ranges from 13 in. to 6 ft. Tubular column, containing counterweight and ram, rotates 360°. Two larger models are available, one with 8 and one with 10-ft lift — *C B Herrick Mfg Corp, 1935 Euclid Ave, Cleveland 15, Ohio*



MULTIPLE NUT SETTER will set from 2 to 5 nuts simultaneously, each to a different torque. It is reported to hold 3% tolerance on production line. Only specially made part is ½-in. steel plate for mounting motor units. Four motor units cover the range from 20 to 120 ft-lb. Offset spindles make it possible to set closely spaced nuts— *Keller Tool Co, Grand Haven, Mich*



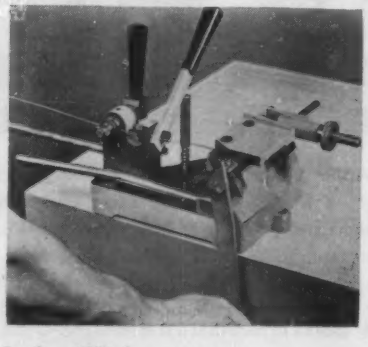
Pressure Blast Roto-Barrel For Production Finishing

Pressure blast Roto-barrel was designed for high-production rate finishing, cleaning, or deburring of such small parts as screw machine products, stampings, castings and extrusions, and precision-machined components. Work is loaded into expanded metal, plastisoled barrel and rolled into interior of cabinet where blast gun, in fixed but adjustable position, aims in the open end.

Variable-speed drive, rated at 0 to 78 rpm, rotates the barrel, exposing the parts to the blast stream. Following the wet-blasting operation, the barrel is manually rolled out of cabinet and the work is rinsed free of abrasive slurry. Entire drive, shaft, and barrel arrangement swivels easily and can be lowered or raised.

The barrel unit may also be used as a manually-operated machine. Armports and knee-actuated triggers are provided for manipulation and actuation of blast gun. The unit is fabricated of stainless steel throughout and no pumps or mechanisms are employed in the blast system. Two blast circuits are available, either regular-velocity which works on suction principle, or high-velocity which operates on pressure tank system.

The Cro-Plate Co, Inc, 747 Windsor St, Hartford 5, Conn

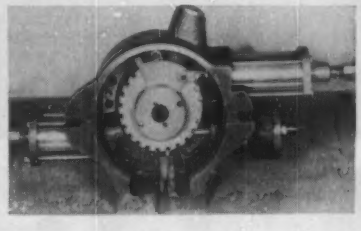


Spring Winder Makes Exact Duplicates

Di-Acro spring winder incorporates unique tension-clamp mechanism that allows making duplicate springs that will test to the same load capacity. Unit can be operated by unskilled worker.

Wire gages up to ⅛-in. dia can be wound into extension, compression, torsion, and flat springs, and round, flat, square, and rectangular stock can be handled. Six arbors are included at price of $85.

O'Neil-Irwin Mfg Co, Eighth Ave, Lake City, Minn



Speed Indexers

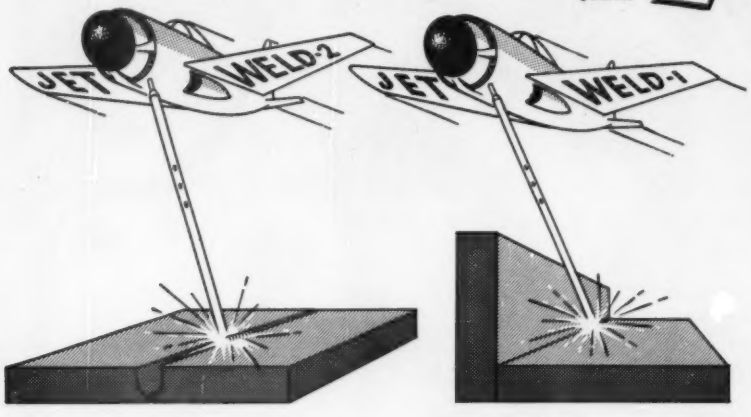
Design feature of Erickson speed indexers is an integral shock control unit. The manufacturer states that this built-in protective device is easily adjustable to meet requirements of varying loads. It is said to assure constant uniform feed while allowing maximum speeds without danger of damage.

The piston of the control unit (at the right) is linked directly to the indexing mechanism, is self-contained, and works independently of the actuating fluid. All Erickson indexers may be operated by either air or hydraulics and used in either vertical or horizontal position. They can be easily connected to table controls or machine tool for fully automatic operation.

The standard 24-position index plate allows an indexing range of 4, 6, 8, 12 and 24 positions. By the use of special indexing parts, up to 100 positions can be obtained. For accurate 120° positioning there is an Erickson 3 position indexer. Prices of indexers start at $365.

Erickson Tool Co, Cleveland, Ohio

THE ACTUAL IS LIMITED: THE POSSIBLE IS IMMENSE
NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT
© LE Co. 1954



JETWELD'S COST-CUTTING TEAM SPEEDS WELDING 35% AND MORE

FOR THE FIRST TIME, Lincoln Jetweld joins powdered metal with the electrode to achieve fastest hand welding speeds ever accomplished. Jetweld's phenomenal speed lies in utilizing the maximum heat of the arc for melting the parent metal, core wire and coating.

GET JETWELD'S COST-CUTTING FACTS TODAY... Have your Lincoln welding engineer demonstrate Jetweld's many cost saving features. Or write for free Bulletin 481.

JETWELD-2
(E-6020)

Extra fast electrode for flat, deep grooves and flat and horizontal fillets.

Tensile strength (As welded) 62,000 psi minimum

Yield strength (As welded) 52,000 psi minimum

Elongation in 2" (As welded) 25% minimum

JETWELD-1
(E-7020)

Extra fast electrode for flat and horizontal fillets.

Tensile strength (Stress relieved) 80,000—90,000 psi

Yield strength (Stress relieved) 65,000—75,000 psi

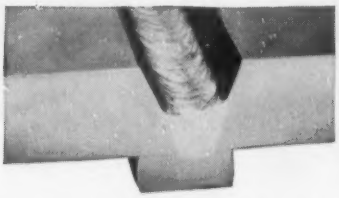
Elongation in 2" (Stress relieved) 25%—30%

Jetweld electrodes have been tested and approved by the American Bureau of Shipping and are certified to conform to AWS classes E-7020 (Jetweld 1) and E-6020 (Jetweld 2).

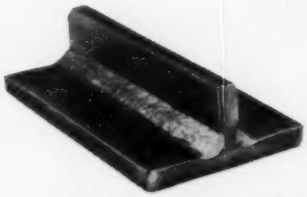
This certification authorizes the use of these two electrodes in shipbuilding supervised by the American Bureau of Shipping and the U. S. Coast Guard.

BENEFIT THREE WAYS WITH LINCOLN JETWELD

35% AND FASTER welding speeds are possible with the new Lincoln Jetweld electrodes. That's because powdered metal coatings utilize the heat of the arc more efficiently to increase welding speeds. Iron powder, melted by excess heat available in the arc, becomes an additional source of metal for the weld.



HIGHER QUALITY Weld metal is uniform, of X-ray quality, free of undercut with improved impact values at low temperatures. There is no coating breakdown . . . stub losses are less. Bead appearance is smooth . . . looks like an automatic weld.



LESS CLEANING is required with Jetweld. Heavy coating and short arc prevent spatter. Slag is self-cleaning. Excellent "wash-up" eliminates undercutting and entrapped slag.

THE LINCOLN ELECTRIC COMPANY

Dept. 2002

CLEVELAND 17, OHIO

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

ROCKFORD *Hydraulic* SHAPERS

Rockford Openside Shapers provide numerous improvements in the production of small planing and large shaping work. Reciprocation of the work, instead of the tool, provides planer accuracy, eliminates overhang and reduces wear. Stroke lengths, feed and cutting speeds are quickly adjustable within the range of the machine.

A wide variety of sizes—36″, 48″, 60″ and 72″ stroke are available.

Investigate these shapers . . . as modern in machine tools as tomorrow's jets.
A Rockford Machine Tool Co. representative will give you complete information.

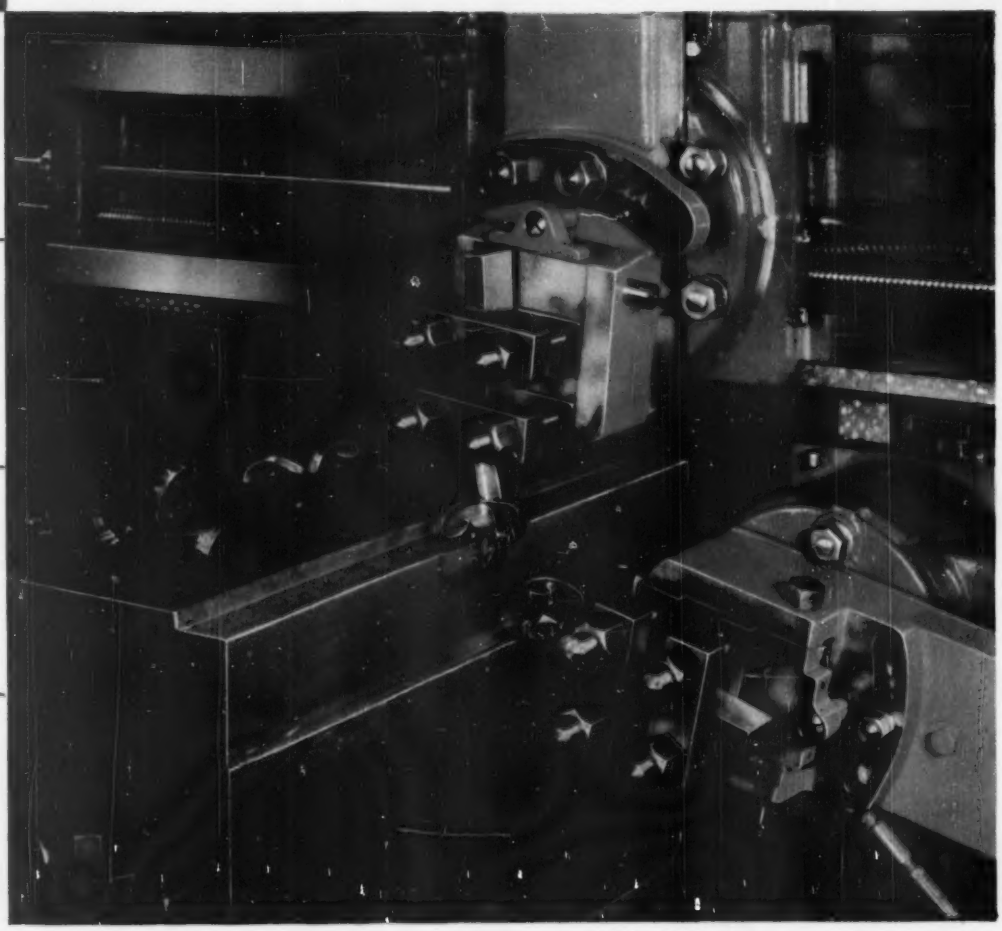
FEATURES:

Side Head

Hydraulic Tool Lifters (For Rail and Side Heads)

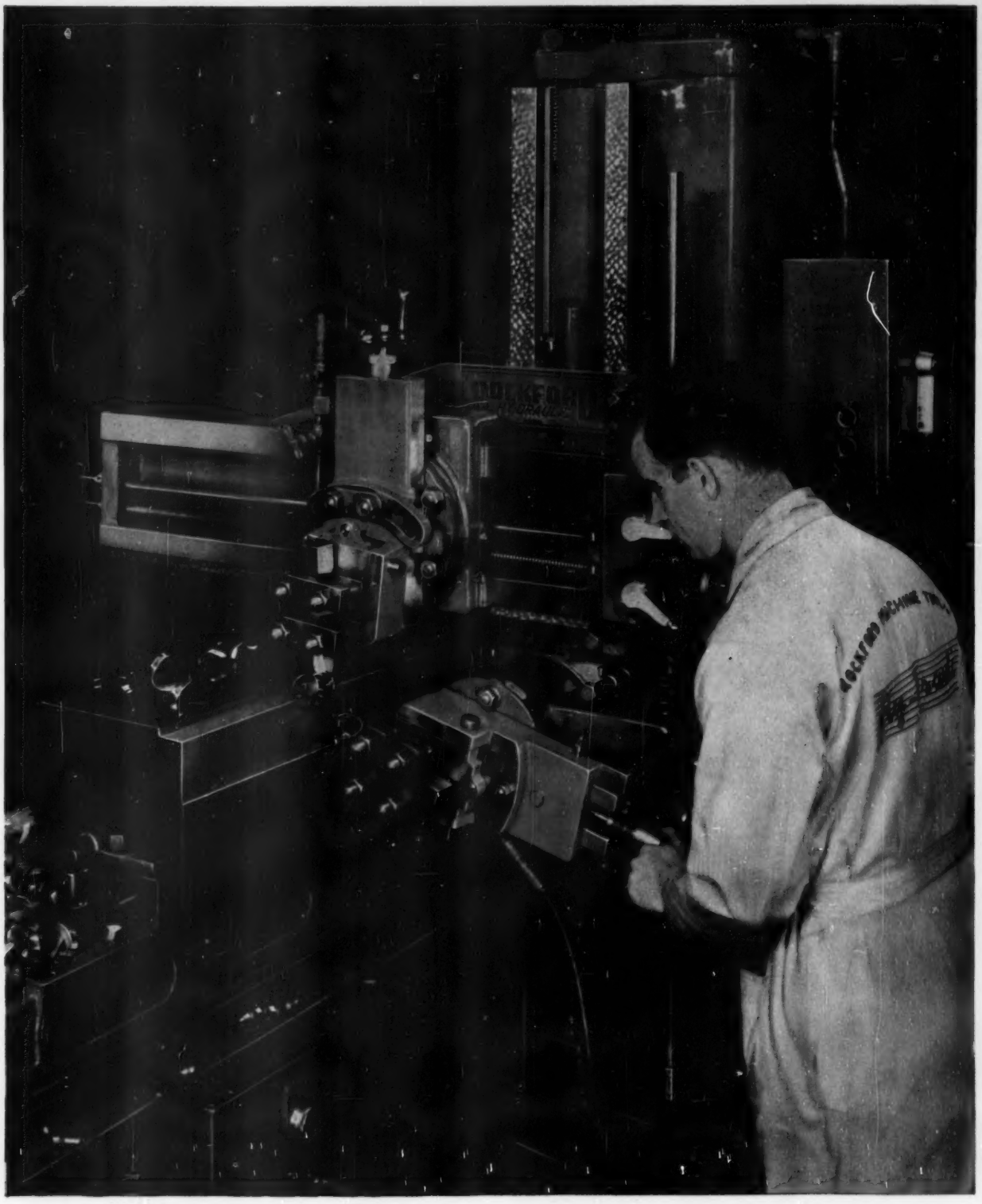
Power Rail Elevation

10 hp 1200 rpm
220/440 volt
3 phase 60 cycle
Open Ball Bearing
Motor and Control



shaping • planing • duplicating • turning

OUR 51st YEAR



Rockford Machine Tool Co. Rockford, Illinois

Well, he had to do *something* . . . production falling off, employees dropping out, new people hard to find. So this plant super took a long look at his assembly operations . . . soon found the engineered answer in American Phillips Screws that are easy to handle, easy to drive, easy to build new profits on. Nothing difficult or long-drawn-out about this procedure . . . *you* can start right now. Write:

SINCE 1838

AMERICAN SCREW COMPANY

PHILLIPS HEADquarters
WILLIMANTIC, CONNECTICUT

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Willimantic, Conn.
Office & Plant, Norris'own, Pa.
Office & Warehouse, Chicago, Ill.
Office, Detroit, Michigan

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FOR YOUR INFORMATION

FREE Catalogs, Booklets, Charts, Calculators

FYI—these initials symbolize information that's important. And there is much of importance in the literature listed here. To get the ones you need, all you do is fill out one coupon for each booklet you wish to order. Indicate in the circle on the coupon the number of one catalog wanted. When you have filled out a card, detach, stamp, and mail. We'll do the rest.

MACHINES AND ATTACHMENTS

1 DRILLING AND TAPPING MACHINE—*Edlund Machinery Co, Cortland, NY.* 7-page bulletin 150 illustrates improved high-speed ball-bearing motor spindle units; Model 2 MS for general production, Model 4 MS for heavy work. Combination arrangements with attachments adapt machine for specific requirements.

2 INVERTED HYDRAULIC PRESSES —*Walter P Hill, Detroit 19, Mich.* 2-page catalog sheet describes line adapted to bending and extrusion operations on tubular parts, as well as upsetting, drawing, and coining, requiring special equipment on standard presses. Data and specifications provided for three types.

3 SMALL HOLE DRILLING MACHINE — *Hamilton Tool Co, Hamilton, Ohio.* 6-page bulletin AM-54 illustrates features of A-M Super Sensitive precision unit for production work. Arrangements for specialized applications described.

4 AUTOMATIC TURRET LATHE— *Potter & Johnston Co, Pawtucket, RI.* 12-page bulletin 133 illustrates data on the 5D-2-6-in., 5D-2-12-in. and 5D-2-15-in. Power-Flex units. These 2-spindle models are designed for production work. Air-operated chucking equipment and special features pictured.

5 SPECIALIZED PRODUCTION EQUIPMENT — *Peerless Production Co, Detroit, Mich.* 28-page catalog illustrates and describes 18 special machines. Tooling and parts processed by each are shown.

6 TURRET LATHE — *Warner & Swasey Co, Cleveland 3, Ohio.* 12-page booklet describes line of heavy duty units with 16 spindle speeds and simplified headstock. Construction features illustrated, specifications included.

7 HORIZONTAL BENCH MILLING MACHINE—*Elgin Tool Works, Chicago 18, Ill.* 4-page folder gives features, specifications, and accessories.

8 HYDRAULIC SURFACE GRINDER —*Thompson Grinder Co, Springfield, Ohio.* 8-page catalog B-53 illustrates and describes Type B unit, size range from 6 x 18 in. to 12 x 120 in. Contains specifications, features, clearance drawings, and wheel sizes for each machine.

9 SUPERFINISHING MACHINES — *Gisholt Machine Co, Madison 10, Wis.* 32-page Form 1160 includes description of process, specifications on 12 machines and 5 attachments available; 28 job applications illustrated.

TOOLS AND ACCESSORIES

10 CENTR-FINDER VISE—*Black Drill Co, Cleveland 17, Ohio.* Illustrated folder describes tool for locating centers or other predetermined points, regardless of shape or varying sizes of parts, within 0.001 in., horizontally and vertically.

11 AIR TOOLS—*Aro Equipment Corp, Bryan, Ohio.* 76-page catalog 61 describes complete line. Specifications, features of each illustrated. Accessories listed.

12 ELECTRICAL TEST EQUIPMENT —*Electro Tech Equipment Co, New York 18, NY.* 190-page instruments catalog 54 contains illustrated data on meters, special industrial controls, and a wide variety of miscellaneous testing equipment.

13 IMPACT TOOLS—*Black & Webster, Newton 58, Mass.* 8-page illustrated catalog describes line of solenoid-operated production tools, including Electro-punch, Electropress, and accessories. Application data included.

14 METAL CUTTING TOOLS—*Weddell Tools, Rochester 11, NY.* 32-page catalog describes Tri-Bit (triangular tool bit) tools. Includes data on speeds and feeds, grinding and maintenance, cutter mounting, and specifications for tool layout purposes. Request on company letterhead.

15 TAPS—*Reiff & Nestor Co, Lykens, Pa.* 36-page catalog 10 offers complete data on size, threads, flutes, and prices for standard and specials. Solution of specific production problems included.

16 OPTICAL COMPARATOR—*Pertmen Instrument Co, New Rochelle, NY.* 12-page brochure illustrates Model E-300 with multiphase optical system. Construction features and accessories pictured and described.

Name .....
Title .....
Company .....
Co. Address .....
.....
AMERICAN MACHINIST, New York

FILL IN BELOW NUMBER OF ONE CATALOG WANTED ( )

Not good after July 1, 1954

(duplicate of the above coupon)

FYI
FOR YOUR INFORMATION

17 CARBIDE TOOLS—*DoAll Co, Des Plaines, Ill.* 12-page brochure describes variety of carbide-tipped single point cutting tools. Standard unground tips as well as tips for threading tools, reamers, scrapers, are shown. Carbide inserts and tips for lathe and grinder centers listed.

HEAT TREATING AND WELDING

18 WELDING EQUIPMENT—*National Welding Equipment Co, San Francisco 5, Calif.* 36-page catalog lists and illustrates welding and flame-cutting equipment. Information brochures with construction details and operating suggestions listed.

19 STRANDED ELECTRODES — *Air Reduction Sales Co, New York 17, NY.* 12-page reprint from the Welding Journal discusses use of stranded wires in the inert-gas-shielded metal-arc consumable electrode Aircomatic welding process.

20 THERMISTORS — *Carboloy Dept, General Electric Co, Detroit, Mich.* 52-page manual TH-13 covers new data on units, applications, functions, characteristics. Illustrations indicate style best adapted to specific application.

PLANT SERVICE EQUIPMENT

21 LIFT TRUCK—*Clark Equipment Co, Battle Creek, Mich.* 8-page brochure illustrates design, operation, maintenance of Hydratork drive torque converter and special-design constant-mesh transmission. Operational advantages discussed and illustrated.

22 BELTING—*B F Goodrich Co, Akron, Ohio.* 32-page manual provides data on splicing and repairing of conveyor and elevator belting. Describes materials, tools needed, methods and special procedures.

23 BATCH CLEANING—*Magnus Chemical Co, Garwood, NJ.* 8-page bulletin covers Aja-Lif cleaning machines for metal parts. Applications illustrated.

24 CHAIN DRIVE — *Ramsey Chain Co, Albany, NY.* 19-page catalog 154 contains data on operating characteristics and service factors of pre-selected drives. Ordering information, lubrication, installation, and maintenance included.

25 ELECTRICAL MODERNIZATION—*Westinghouse Electric Corp, Pittsburgh 30, Pa.* 16-page booklet B-6133 describes and illustrates advantages for increased output, lower operating cost, reduced downtime and maintenance.

26 BLAST CLEANING ACCESSORIES —*Pangborn Corp, Hagerstown, Md.* 28-page booklet 300C describes accessories and supplies available. Engineering and selection data covers abrasives for specific requirements.

27 VACUUM CLEANING SYSTEM—*Air Appliance Div, US Hoffman Machinery Corp, New York.* 12-page bulletin A-989 describes permanently installed system with central dust collection. Illustrates range of accessories. Portable units illustrated.

28 SILENT CHAIN DRIVES — *Link-Belt Co, Chicago, 1, Ill.* 32-page book No. 2425 illustrates versatility of applications. Design features, selection procedure, tables, and computations included, as well as components, operational, and technical data.

PARTS AND MATERIALS

29 MOTORS—*Brook Motor Corp, Chicago 45, Ill.* 6-page illustrated folder, describes line of 1 to 50 hp ac units, single phase capacitor and polyphase squirrel cage. Includes selection guide charting electrical and mechanical features of standard and special motors.

30 UNALLOYED TITANIUM—*Mallory-Sharon Titanium Corp, Niles, Ohio.* 4-page booklet gives properties of commercially pure Grade III. Contains recommended techniques for fabricating and forming titanium sheet.

31 ELECTRIC ACTUATORS — *AiResearch Manufacturing Co, Los Angeles 45, Calif.* 64-page catalog outlines applications and specifications of 20 basic types of linear and rotary actuators. Includes charts and engineering drawings.

32 STAINLESS STEEL SELECTOR CHART—*Crucible Steel Co of America, Pittsburgh 30, Pa.* Indicates which type should be used for about 95% of operations. Front contains comparison of physical and mechanical properties, and elevated temperature properties; reverse gives a large number of stainless characteristics.

33 HYDRAULIC CYLINDERS — *Petch Manufacturing Co, Detroit 2, Mich.* 32-page loose-leaf catalog contains specifications and engineering data on air and both high and low pressure cylinders.

34 BERYLLIUM COPPER STRIP — *Penn Precision Products, Inc, Reading, Pa.* 8-page bulletin No. 1 contains complete data for specifying precision strip. Discussion of available alloys, conditions and tempers is included, with tables covering available sizes and properties.

35 HYDRO-MECHANICAL DEVICES —*Pathon Manufacturing, Cincinnati, Ohio.* 32-page bulletin 32 covers line, including oil hydraulic cylinders and hydraulic directional control valves. Includes tables of sizes and engineering data on various models.

36 STEEL PRODUCTS — *Jones & Laughlin Steel Corp, Pittsburgh, Pa.* 226-page indexed warehouse stocklist and reference guide carries complete listing of items. Section includes decimal equivalents, sheet gage weight, thickness and order limits, typical heat treatments, machinability ratings.

37 MEEHANITE CAMS, CAMSHAFTS, AND CRANKSHAFTS — *Meehanite Metal Corp, New Rochelle, NY.* 12-page illustrated booklet covers application problems. Describes basic metallurgy and engineering properties of a few of the types of Meehanite metal most widely used for such service.

38 GAGES—*H C Clatefelter Co, Oak Park 37, Mich.* 32-page catalog contains detailed data on tolerances, wear allowance, gaging principles and practices. Covers indicating and gaging fixtures, and adapter bushings. Specifications and prices given.

MISCELLANEOUS

39 METAL STAMPINGS — *Kickhaefer Mfg Co, Milwaukee 4, Wis.* 64-page catalog 653 contains engineering drawings and specifications for stampings. Contains information for ordering wide variety of parts made to specifications without charges for dies.

Reader Service Department
American Machinist
330 W. 42nd St.
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Place 3¢ Stamp Here

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CUTTERS · BROACHES · SPECIAL TOOLS

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BRAD FOOTE GEAR WORKS, INC.
CICERO 50, ILLINOIS

56-page Catalog *of tools for making*

WORMS — WORM GEARS
HERRINGBONE — SPUR
STRAIGHT BEVEL — ZEROL
INTERNAL — SPIRAL BEVEL
RACKS — ACME SCREWS
SPROCKETS — SPLINES
KEYWAYS

Here's the Way You Can Save Money on Gears

During the many years BRAD FOOTE has been making gears, we have accumulated a large variety of hobs, cutters, and broaches which we have used to make thousands upon thousands of gears to order. With this stock of tools, we are able to do just about any gear cutting job you may have.

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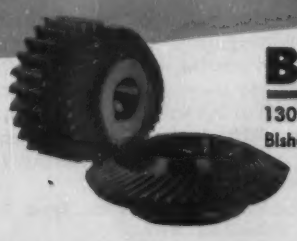
Write today on your company letterhead for a free copy of this big catalog which shows all the important specifications needed by gear designers. You'll find it convenient to use, and it will save you money on the gears you buy.

IMPORTANT NOTE: *If you now make your own gears, ask for a copy anyway. You may find that it is cheaper for us to make them.*



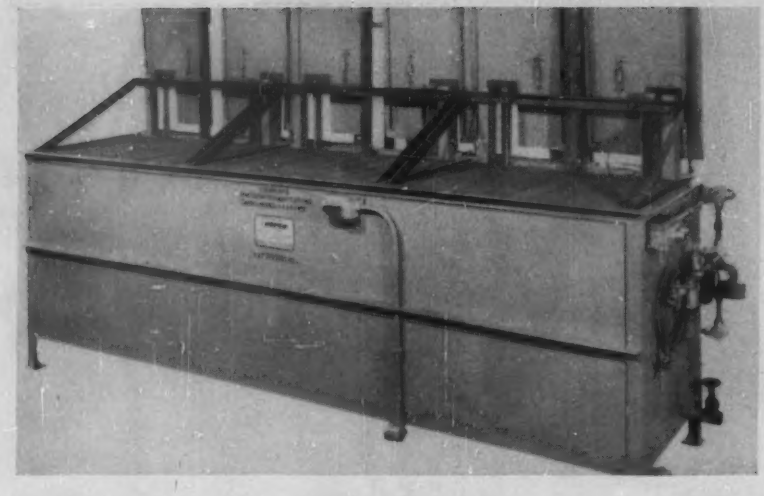
BRAD FOOTE GEAR WORKS, INC.

1309 South Cicero Avenue • Cicero 50, Illinois
Bishop 2-1070 • OLympic 2-7700 • TWX: CIC-2856-U

subsidiaries

AMERICAN GEAR & MFG. CO. • Phone: Lemont 920 • Lemont, Illinois

PITTSBURGH GEAR COMPANY • Phone: SPaulding 1-4600 • Pittsburgh 25, Pennsylvania



Automatic Parts Washer Has Three Compartments

Cooper triple automatic parts washer was developed for cleaning metal parts, paint stripping, rinsing, and similar cleaning and dipping operations. Each of the three compartments is a complete tank with separate controls, and each is equipped with a rack upon which spare parts are placed.

By pushing a switch the rack is lowered to the bottom of the tank and automatically agitates the parts in solution. A second switch stops agitation and rack rises flush with top of tank for unloading and reloading. All electrical switches and connections are explosion proof for safety. Back is raised and lowered by air pressure.

Other models are available with single compartment, two compartments, or combination of two or three compartments with all compartments agitating.

D C Cooper Co, 1467 S Michigan Ave, Chicago 5, Ill

Leak Testing of Castings With Standard Cabinet Unit

Moore equipment uses a pneumatic system which operates on plant air supply and eliminates dunking with usual need for drying and rust prevention. Measurement is indicated on a large gage and classified into accepted and rejected parts by signal light indication. Output connections provide for electrical operation of supplementary sorting and marking equipment.

The system pressurizes the cavity of the work, then measures and amplifies the difference between the original fill pressure and its lowered value if a leak is present. Amount of pressure change within established test time becomes a direct measurement of magnitude of leak. Since system measures and amplifies pressure-difference, comparatively small leakage results in wide motion of gage pointer.

Standard cabinet unit can be used to measure a wide range of workpieces and leak tolerances. Fill pressure, time of test, and limit of allowable leakage can be adjusted to suit quality level desired.

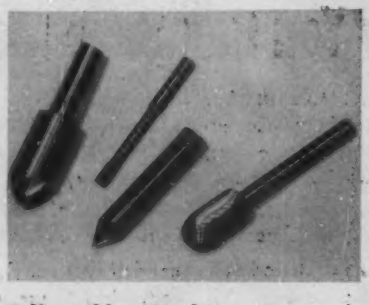
Moore Products Co, H and Lycoming Sts, Philadelphia 24, Pa

Radiation Gage for Small Rolling Mills

Designed to measure thickness of strip on small, compact cold-reduction mills, radiation gage has measurement range of 0.00005 to 0.060 in. It measures 10½x4½x26 in. and is positioned by leadscrew mechanism which enables it to traverse strip up to 6 in. in width.

The unit features an automatic standardization cycle which periodically enables the gage to compensate for error-producing variables such as changes in temperature, humidity, and dust collection on the radiation window.

Industrial Nucleonics Corp, Columbus, Ohio

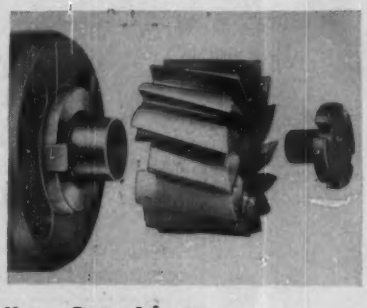


Heller Adds to Tool Line

Heller tool line has been expanded to include:

Chatterless countersinks in both high-speed steel or carbide to take heavy cuts and produce smooth seats; solid carbide center lap to replace mounted points for lapping centers in metal parts after hardening of the steel; carbide and internal grinding burs to be used in place of mounted points and internal grinding wheels for smooth finish, elimination of dressing, and longer life.

Heller Brothers Co, Newcomerstown, Ohio



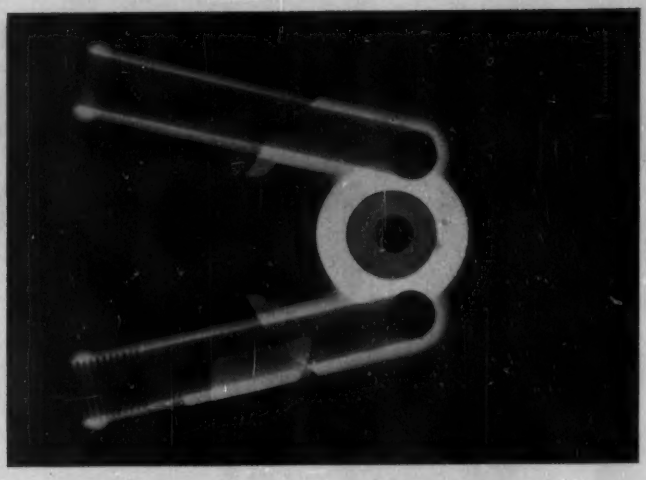
Heavy-Duty Adapter For Shell End Mills

Quick-change-type sheel end mill adapter is standardized for No. 50 N S drive milling machines made available in two arbor sizes which fit standard shell and mill bores. The adapter mounts directly on the front spindle flange of the machine. Standard bolt holes and key slots provide for rigid mounting and positive drive.

Greater tool rigidity is provided by bolting direct to the spindle, giving full bearing on spindle face. Concentricity is assured by locating from the OD of the spindle. Manufactured from 8620 steel and case-hardened, the adapter has hard bearing surfaces that will not score.

Goddard & Goddard Co, 12280 Burt Rd, Detroit 23, Mich

More for the money?



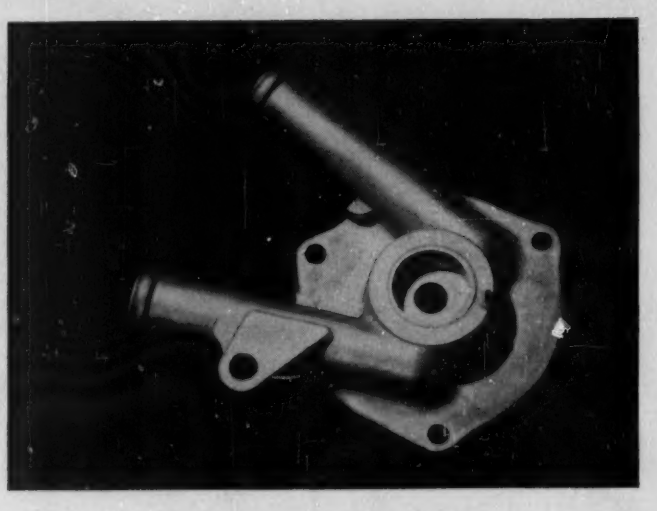
RADIOGRAPHY SHOWED HOW

This casting was a part for an automotive heater. With a big run and a low price, profit hinged on a high yield of sound castings.

Radiographs made of pilot castings revealed a few recurring faults and indicated how a minor change in casting technics could increase the yield.

This is just one more example that shows why it pays to use radiography—one more reason you find more and more progressive suppliers of castings using it.

If you want to be known for releasing only high-quality work, if you want to improve production—look into radiography. Your x-ray dealer will be glad to show you how it can help. And, if you wish, we'll send you a free copy of "Radiography as a Foundry Tool."



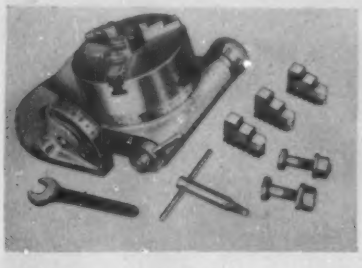
Radiography . . .

another important example of photography at work

EASTMAN KODAK COMPANY
X-ray Division, Rochester 4, N. Y.

Kodak

CONTROLLED-ATMOSPHERE electric furnace with double chamber is 12x12x20 with quench tank and atmosphere generator to fit. Gages for proportioning the gas and air are at side; gas curtain and piloted outlet are provided. Furnace has a foot-operated door; drawing furnace a swinging door. It can be made in any size to suit particular applications—*Waltz Furnace Co, Dept 1, Symmes St, Cincinnati, Ohio*



Preis Dividing Head Is Fully Adjustable

Dividing head adjusts from horizontal to vertical position, rotates 360°, and has a fine adjustment in minutes for rotary micro setting. It includes a 3-jaw, 3-step chuck for maximum adaptability.

The unit, designated Model DH-4, is intended for use in engraving, drilling, light milling, profiling and layout work on dials, cams, templets, and cylindrical parts. For free rotation of the chart when positioning or preliminary to use of the worm shaft with minute adjustment, lever at one end of worm shaft disengages worm gear.

Each head is furnished complete with two sets of jaws, one chuck wrench, one open end wrench and two bolts with nuts and washer. External chucking capacity is 4⅛ in.

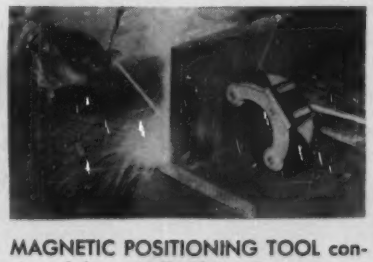
H P Preis Engraving Machine Co, 15 Industrial Branch, Hillside, NJ

High-Pressure Cup Packing Uses Impregnated Leather

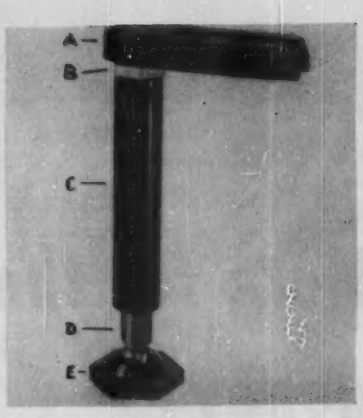
Thiokol liquid polymer impregnates the leather used in a new cup packing. Units are fully impregnated and thus combine resilience of rubber with toughness of leather. Packings are reported to perform well under pressures of 0 to 15,000 psi and temperatures from –65 to +200 F.

Sample of test results using the new packing indicate that the packing life on a pneumatic cushion of an automotive stamping press was increased tenfold.

Thiokol Chemical Corp, 780 N Clinton Ave, Trenton, NJ



MAGNETIC POSITIONING TOOL consists of three 45-lb Alnico 5 permanent magnets held in die-cast, high-tensile aluminum frame with 360° adjustment. When positioned, each magnet can be locked in place. Unit will hold almost every shape or design of metal —*Standard Portable Cord Co, Inc, Jamestown, NY*



Tool Clamps Work to Machine Tool Table

Q-clamp has been developed by Techno Products. It is an integrated clamp and support which can be adjusted in height quickly and easily. It consists of a series of interchangeable components which will fit together to cover any height from 0 to 49 in. above the machine tool table.

Strap (A) has a threaded opening at the heel to receive a swivel base assembly, consisting of a threaded stud with ball end (D) to match the socket in the swivel base (E). For heights above 5 in., spacer tubes (C) and couplings (B) are provided which fit the threaded strap. Bottom of each spacer tube is tapped to receive swivel base assembly. By using swivel base assemblies of different lengths and adding standard spacer tubes it is possible to clamp any work from 0 to 49 in.

Q-Clamps are made in light and heavy series to accommodate T-slot bolt diameters of ½, ⅝, ¾, ⅞, and 1 in.

Units are made throughout of high-strength alloy steel and straps are supplied in straight, finger and gooseneck models of different lengths made of heat-treated alloy steel tested to over 120,000 psi.

Techno Products, Inc, 1908 E 66th St, Cleveland 3, Ohio

Sahlin Floor Model Unloader

Self-contained floor model unloading machine has been designed for automatic unloading of small and medium-size parts from presses and other metalworking machines.

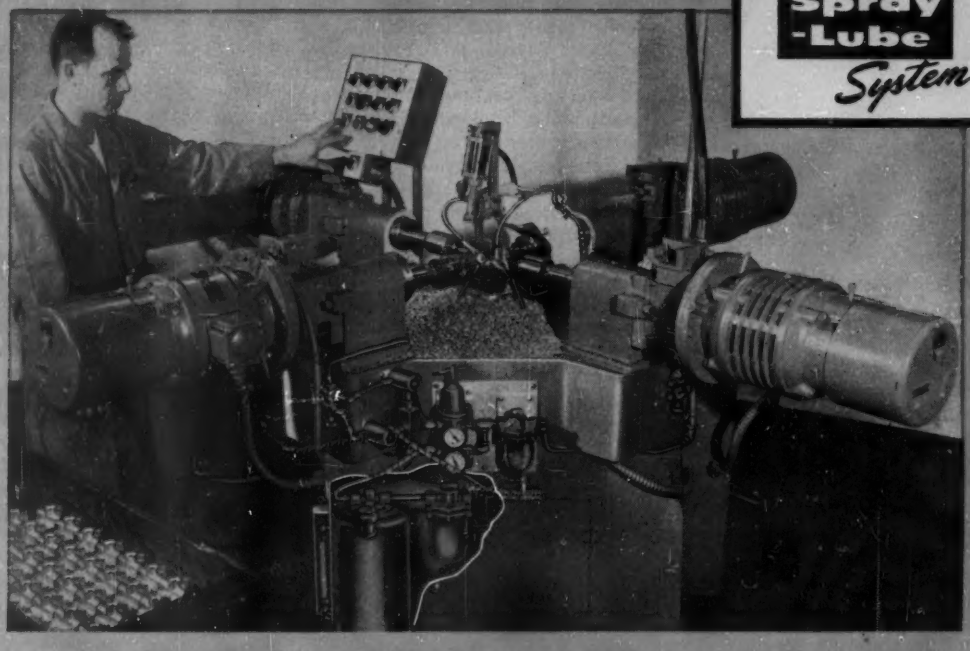
Unit can be supplied with either fixed or roll-away base. Jaw assembly, electrical controls, and air cylinders are similar to those used on the Sahlin swinging-arm unloaders.

Sahlin Engineering Co, Birmingham, Mich

NOW

a quick, low-cost way to "tool-up" for bigger production

NEW *Norgren* **Spray-Lube** *System*



gives more efficient application of cutting oils for

- ***higher cutting speeds***
- ***faster rate of feed***
- ***longer tool life***
- ***lower unit production costs***

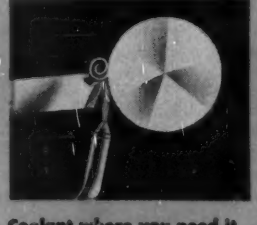
on tapping machines, drill presses, milling machines, grinders, lathes, boring machines, high-speed saws, stamping presses, deep draw presses.

SEE IT AT THE ASTE SHOW

PIONEER AND LEADER IN OIL FOG LUBRICATION FOR 26 YEARS

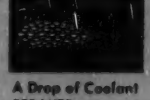
• VALVES • FILTERS • HOSE ASSEMBLIES
• REGULATORS • LUBRICATORS

C. A. *Norgren* CO.
3436 So. Elati, Englewood, Colo.



Coolant where you need it... spray is applied to work area from any required direction to thoroughly lubricate critical areas of contact between cutting tool and work piece.

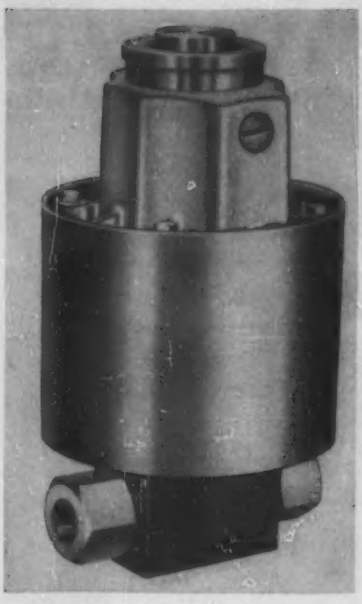
A Drop of Coolant



A Drop of Coolant SPRAYED

Fine spray rapidly dissipates heat... the spray lubricates tool more efficiently; has greater exposed oil surface area for fast, thorough dissipation of heat.

WRITE FOR COMPLETE DATA—NEW FOLDER No. 491



Air-Operated Hydraulic Boost Pump Delivers 30,000 psi

Air-operated hydraulic boost pump features an automatic pilot-operated air selector valve to eliminate stalling. Model 10-302 operates on the principle of differential areas. Design and construction permits either oil or water to be used for testing or powering.

Models presently available have pressure outputs ranging from 0 to 30,000 psi when operating on 80-psi maximum air pressure. Both discharge and volume of fluid can be easily and accurately controlled by air-pressure regulator installed in air supply line. Fluid output capacities range from 2½ gpm at 1000 psi to 8 cu ipm at 30,000 psi.

Physical dimensions are: overall height 15⅝ in.; diameter 7 5/16 in.; weight, 35 lb.

Southern California Hydraulic Engineering Corp, 6318 S Central Ave, Los Angeles 1, Calif

Electronic Controls For Roll Markers

Noble & Westbrook has announced Model 50P1 which is pneumatically operated and electronically controlled, and which operates semi-automatically. All controls are mounted in a separate floor panel fitted with plug-in connections.

Another new machine is dial-type Roll-O-Matic which features 12 stations, automatic operation, and automatic unloading. Only manual work is loading the parts onto the dial.

Noble & Westbrook Mfg Co, 17 Westbrook St, East Hartford, Conn

Stretch-Forming Press Handles Magnesium Parts

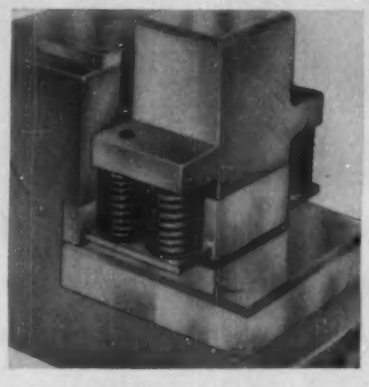
Self-contained stretch-forming press with shell die made of sheet steel ranging from 0.074 to 0.125-in. thickness and combining thermostatically controlled heat will stretch-form magnesium parts for aircraft such as outside skins, fairings, panels up to ⅛-in. thickness.

The Lalli die eliminates hammering and expensive stretch presses. Inexperienced labor can reportedly operate the machine. Press illustrated occupies 2x3 ft. of space.

A major advantage is said to be the low cost of the dies which are shell type and cost less than half the conventional stretch-press dies. Materials to construct the die run less than one-quarter by comparison. Doors and panels are made to 0.004-in. thickness stretched over dies of 0.074-in. thickness with skins retaining structural strength.

Pyrometer thermostatic control assures accuracy; operator controls the amount of stretch by operation of hydraulic hand or motor-driven pump.

R A Lalli Co, 267 Madison Terrace, Bridgeport, Conn



Open and Confined Toolset Notching Units

Notching units are self-contained permanently aligned punches and dies which eliminate time consuming adjustments and all attachments to the upper ram of the press. Lifter springs, punch and die, are contained in a single holder.

Notching units have shut height of 6 5/16 in. and die height of 2 19/32 in. Both units can be used together without adjustment or shimming. Punch sizes available in both open and confined types are 2x2, 3x3, and 5x5 in. Standard units are available in corner notching, 90°-V notching, and angle-notching types.

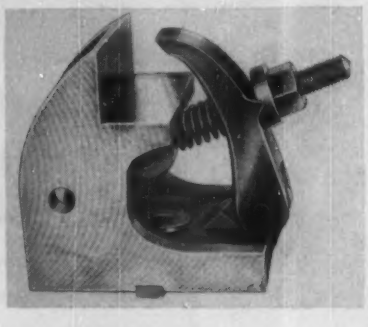
Toolset, Div General Riveters, Inc, 777 Hertel Ave, Buffalo 7, NY

Angle and Surface Plates

Beaver Industries is manufacturing high-precision angle and surface plate sets for use in rescraping the dovetail cross slides, vertical slides and turret slides of B&S automatic screw machines. Castings of fine-grade Meehanite are rough machined, then subjected to heat treatment by normalizing operation, followed by deep-freeze stabilizing operation and finish machining. Final operation is precision hand scraping.

Complete set includes flat surface plate, dovetail angle plate, two hand scrapers, tube of "high-spot blue," and laboratory wooden box for storage. Sets are available in two sizes: Type O for B&S Models O, OG, 2 and 2G; Type OO for B&S Models Nos. OO and OOG.

Beaver Industries, 1500 W Adams St, Chicago 7, Ill



Hart Milling Fixtures Eliminate Special Jigs

Milling fixtures are said to provide an inexpensive alternative to making special jigs and fixtures for hundreds of different jobs on miller, shaper, drillpress, and tapping machines. Units are easily attached to the machine and will hold round, hexagonal, octagonal, or square stock in any position.

They are available in four sizes from the ¾-in. model (½ to 1⅛-in. capacity) to the 4-in. size (2½ to 4½-in. capacity).

Walter W Field & Son, 41 Hayward St, Cambridge 42, Mass

Time to Reduce Milling Costs!

COSTS DOWN!
PRODUCTION UP!
No. 1-8
8" table travel... 25" x 9" table... automatic hydraulic table feed.
No. 2-20DS
Double Spindle for two milling operations at same time... 20" table travel ... 42" x 12" table.
No. 2-20
20" table travel... 42" x 12" table.. fully automatic hydraulic table feed.
No. 1-14DS
Double Spindle for two milling operations at same time ... 14" table travel ... 32" x 9" table.
No. 1-14
32" x 9" table ... 14" table travel ... hydraulic table feed ... full automatic cycle.
No. 1-V
Hydraulic vertical head feed ... 5½" head travel ... 25" x 9" table.
No. 2-20V
20" table travel... vertical spindle with speed range 32 to 1284 R.P.M. ... 42" x 12" table.
No. 1-M
Hand feed to table and head ...25" x 9" table ... Adjustable head counterbalance.

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BUFFALO
Don W. Patterson

CHICAGO
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Hunter Machine Tool Co.

DAYTON
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DETROIT
A. C. Haberkorn Mach'y Co.

FT. WAYNE
Ossis Machinery Co.

GRAND RAPIDS
Joseph Monahan

HAMILTON, ONT.
F. F. Barber Mach'y Company

HARTFORD
Harrington Machinery, Inc.

HOUSTON
Oliver H. Van Horn Co., Inc.

INDIANAPOLIS
Ossis Machinery Co.

KANSAS CITY
Richman Machinery Co.

LOS ANGELES
Germain Mach'y Co.

MILWAUKEE
Four States Mach'y Company

MINNEAPOLIS
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MOLINE
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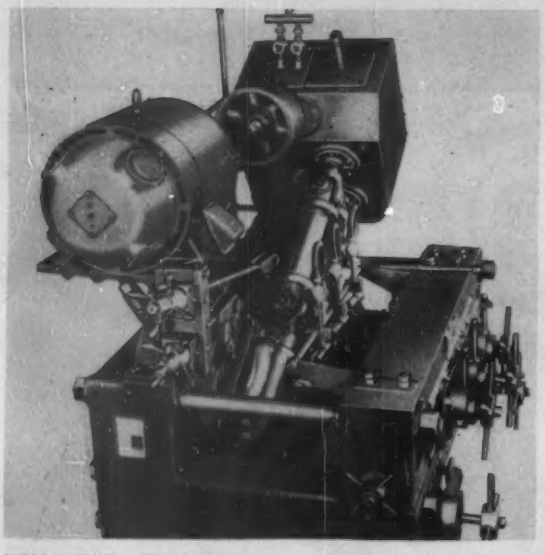
Kent-Owens machines assure you of speed with accuracy ... and cut your milling costs! Designed with advanced features ... performance-proved for meeting tough schedules in production milling. Rugged ... simple ... versatile. Twin-post head mounting assures balanced load. Greater cutting efficiency—only two gear contacts, motor to cutter. Write for bulletins on wide range of hydraulic and hand-operated machines. Also, let Kent-Owens design and build your tooling and special machines. Kent-Owens Machine Co., Toledo, Ohio.

Call on

KENT-OWENS

for Milling Machines



HEAVY-DUTY STRAIGHTENER, model 1½BC, handles hot-rolled bars and heavy-walled tubes, has water-cooling system for handling special alloy bars at high temperatures. Tubes from 5/16 to 3-in. OD and bars to 2-in. dia are handled with straightening speed ranging to 400 fpm. Five-roll principle distributes loads over three points —*Sutton Engineering Co, Bellefonte, Pa*

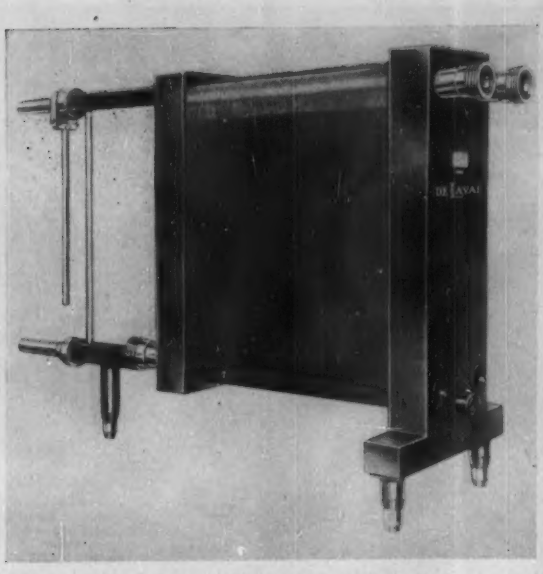


PLATE HEAT EXCHANGER has corrugated plates pressed from heavy stainless steel stock to withstand higher than average operating pressures. Plates are invertible so exchanger may be altered from time to time. Inlet and outlet ports can be varied without use of extra plates. Units are available in variety of models and sizes — *The De Laval Separator Co, Poughkeepsie, NY*

Air Turbine Hand Tool For Milling and Grinding

Newage Lorantco hand air-turbine grinder and miller comes in three sizes operating at speeds of 85,000, 75,000, and 55,000 rpm. The turbine provides an unusually wide range of spindle speeds designed for use with tungsten carbide and HSS burs, precision grinding points, abrasive- and diamond-impregnated wheels.

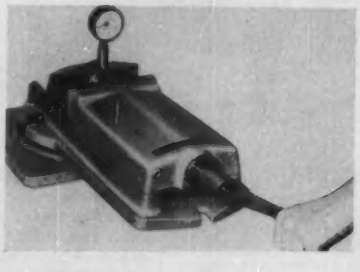
The tools can be used profitably to cut down non-operating time in sharpening a wide range of HSS and tungsten-carbide cutting tools because it is not necessary to remove the cutting tools from their holders. High metal removal rates are another feature reported by Newage. Internal and external and thread grinding can be performed.

Wide range of spindle speeds are available with speeds selected by simple movement of twist-grip knob incorporated in body.

Body of light weight and medium weight tools is of special light alloy. Heavy-duty tool features steel body. Collet is made from high quality collet steel heat treated and ground. It has opposed, externally tapered parts to ensure concentric running.

Tools are designed for operation on air pressure from 60 to 100 psi.

Imported by Newage International, Inc, 235 E 42d St, New York 17, NY



Self-Contained Hydraulic Vise

Precision tool has no pump, hoses, or tubes to interfere with its use. Designated the Hilma-Hydrovise, it combines the elements of a mechanical vise with those of hydraulic power transmission. When the vise handle is turned clockwise jaws close mechanically until clamped object is encountered. At that point a clutch is automatically activated and additional force to 8,750 lb is applied hydraulically.

Key to mechanical-hydraulic action of the vise are two concentric spindles. Outer spindle is threaded to turn within vise housing; inner spindle turns within outer spindle. Two spindles are connected through an adjustable clutching device. As handle is first turned clockwise both spindles revolve and mobile jaw is brought into contact. As resistance increases, clutch disengages. Outer spindle is held stationary and inner spindle moves to actuate plunger and hydraulic cylinder until max clamping force is obtained.

Vise is available with or without swivel base. Jaws are 2 in. high and 6 9/32 in. wide with max opening of 5 in. Price is $285.

American Tooling Corp, 60 E 42d St, New York 17, NY

Bustin Firm-Grip grating, Type B, is especially manufactured with ½ of a diamond opening 13/16 in. between bearing bars. Close dimensions combine safety with comfortable walking under the most adverse conditions where grease, oil, and water cause accidents from slipping.

Bustin Firm-Grip Grating Corp, Dover, NJ

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QUALITY
THAT CAN BE EASILY SEEN—
READILY PROVED
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noticeably shown in longer file life, better work, higher production and lower operating costs
"FILE FILOSOPHY"—FREE. 48 illuminating illustrated pages on kinds, use and care of files. Send for it.
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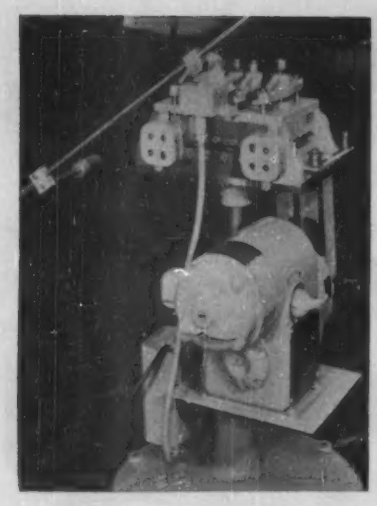


Power-Driven Straightener Uses Variable Speed Drive

Light-duty power-driven straightener is arranged with variable speed drive unit in place of single-speed motor. It is suitable for cold-rolled steel up to 6x⅛ in.

Pair of power-driven take-in rolls, 7 plain straightening rolls, pair of power-driven take-out rolls, 5 to 1 variable-speed drive, output of 10 to 50 fpm, mercury-switch lube control arrangement, and ½-hp motor are specifications incorporated.

Mercury-switch lube control arrangement maintains loop of material between straightener and press or machine with which it is used. The straightener can also be employed for material which comes in strip form. Same type of unit is made in 10 and 12-in. capacity.

United States Tool Co, Inc, Ampere, East Orange, NJ

Heavy-Duty Jack

Heavy-duty jack is horizontal in shape with low over-all height. Working mechanism is protected by a cap; working parts are of hardened tool steel. All parts are coated with Parkerized jet-black finish. It is available in three sizes. A vertically constructed spring jack is available for lighter work.

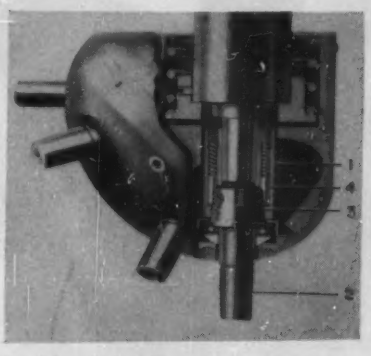
Lodding, Inc, Dept N 63, 79 Beacon St, Worcester 1, Mass

Buck Air Chuck Provides An Accuracy of 0.001

Ajust-Tru 12-in. air chuck has been designed to maintain precision within 0.001 in. It reportedly can save considerable time in machining top jaws. Instead of the difficulties and downtime of turning or grinding jaws on the automatic or regular screw machines, Buck jaws can be machined on toolroom equipment; final precision adjustment is made by the Ajust-Tru principles of the chuck.

Unit also permits using hardened top jaws for long wear without necessity for grinding or re-grinding jaws when chucking or re-grinding.

Buck Tool Co, 2015 Schippers Lane, Kalamazoo, Mich



Positive Drive Increases Drill Turret Capacity

Flying Dutchman positive drive increases the capacity of the Lign-o-matic drill turret. Drive makes it possible to use any tool that can be held and driven by ½-in. chuck. Efficiency is reported constant no matter how heavy the torque or how light the end thrust.

The Lign-o-matic is a six-spindle turret for use on standard drillpress. By indexing the turret, six different operations may be performed with a single drillpress spindle. Basic design is illustrated. Driver (1), and turrent spindle (2) automatically disengage during the last ¾ in. of upward quill movement. When quill is lowered, driver automatically engages selected turret spindle. Mating tapers (3) automatically align the turrent spindle for maximum accuracy. Simultaneously two spring-loaded pins (4) automatically engage slots in the turret spindle.

All Model E Lign-o-matic turrets will include the new Flying Dutchman drive. The new model sells for $285.

Howe and Fant, Inc, South Norwalk, Conn

Depressed-Center Grinding Wheels For Metals and Non-Metals

Carborundum announces availability of Carboflex depressed-center grinding wheels for rough grinding, weld removal, cut-off and slotting operations on ferrous and non-ferrous metals, and non-metallics. Wheels are reported to combine aggressive cutting action with extreme high strength and resistance to cracking. They are constructed with glass-fiber-reinforced resin bond to provide efficient operation with maximum safety.

Designed with a knurled back in addition to the knurled face, the new wheels enable the operator to cut with both sides and the periphery of the wheel without initial dressing. The wheels come in sizes of 7 and 9⅛-in. dia, ⅛, 3/16, and ¼-in. thickness, and contain a ⅞-in. arbor.

The Carborundum Co, Niagara Falls, NY

Scaife Extrusion Process Produces Ordnance Shells

The Scaife method produces the shell in one piece from a simple billet; important features are in the substitution of readily available billet stock for seamless steel tubing, as well as savings of 25% in steel used. Scaife reports that the glass lubricant used in their process facilitates the hot-press forming operation and permits new die designs providing greatly improved dimensional control.

Other advantages cited are: improved surface conditions minimizing subsequent machining; high extrusion ratio; and reduced extrusion pressures.

Scaife Co, Oakmont, Pa

Century Motors'

Unusual Freedom from Vibration Helps Maintain Close Tolerances— With a Minimum of Rejects

Century motors are designed to help you get the accuracy that was built into your modern production machines. They are ruggedly built, carefully machined and well balanced both mechanically and electrically. Century motors are widely known for their unusual freedom from vibration.

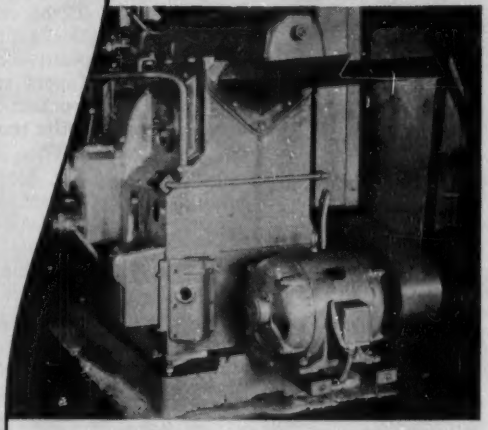
Century motors have wide acceptance from BIG NAME machine tool manufacturers because they mount squarely and solidly and operate with smooth, quiet precision.

You may select Century motors in: open drip proof — splash proof — or totally enclosed fan cooled construction to assure uninterrupted production against various atmospheric hazards.

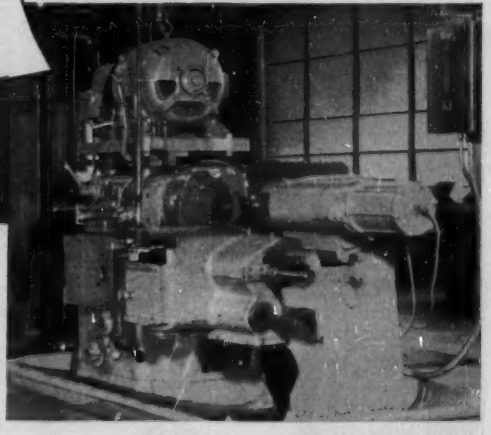
The complete line of Century motors permits selection of the right motor to meet the requirements of your machines. They are built in a wide range of sizes from 1/8 to 400 horsepower. Specify Century for all your equipment.

CENTURY ELECTRIC COMPANY
1806 Pine St., St. Louis 3, Missouri
Offices and Stock Points in Principal Cities

75 Horsepower Century drip proof motor on a copper tube drawing machine.



7½ Horsepower Century drip proof motor on a crank shaper in a tool room.



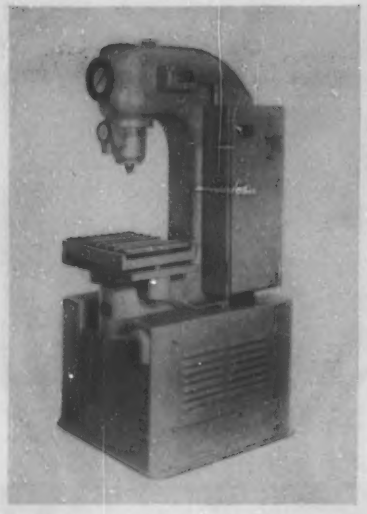
7½ Horsepower Century drip proof motor on a special production lathe.

Century SERVICE
Is Near Any CENTURY Motor Driven Equipment

Prompt Service is offered by CENTURY'S National Network of more than 200 Authorized Service Stations, supervised by 28 Century Sales offices.

1. Facilities for immediate exchange of most CENTURY standard ratings of standard construction are available at CENTURY Authorized Service Stations.
2. CENTURY Authorized Service Stations are qualified and equipped to service and repair any piece of CENTURY apparatus.
3. Genuine CENTURY renewal parts are available at CENTURY Service Stations, CENTURY Parts Distributors and at the factory in St. Louis.

Century C MOTORS

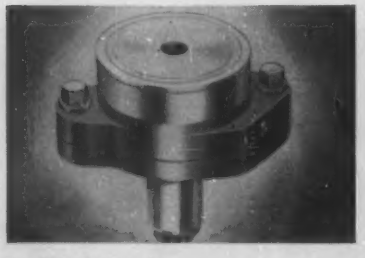


Conveyor-Line Hardness Tester

Brinell hardness testing machine that fits into a roller conveyor line has been developed for production work. Unit facilitates handling of parts in connection with testing operations, thereby speeding machine and operator output.

Roller conveyor section, working in conjunction with the test cycle, allows operator to roll part into position. As cycle begins, rollers drop down out of the way, allowing work to rest on an anvil of hardened rails. Rollers automatically rise again at end of test.

Steel City Testing Machines, 8817 Lyndon Ave, Detroit 38, Mich



Tool & Drive for Deep-Hole Drilling

Boyar-Schultz deep-hole drilling tool oscillates and has additional revolving motion for higher rpm on small drills. Drill with 0.050 dia will go into work 16 times its diameter without pullout.

Compact V-belt drive unit for mounting on No. 00, 0, and 2 automatic screw machines allows easy turret slide motion without jamming. Unit may be used with Boyar-Schultz drilling tools or with other tools.

Boyar-Schultz Corp, 2110 Walnut St, Chicago 12, Ill

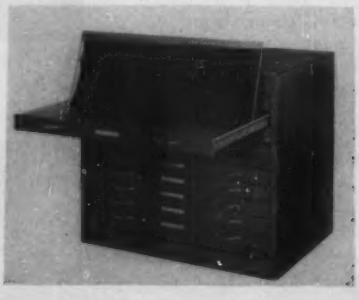
Logan Locking Chuck

PRO (power release only) chuck remains locked in closed position until it is positively opened by the operator. Neither centrifugal force nor power failure will cause release of work as chuck is revolving on the machine spindle. Body of chuck is slotted radially to accommodate jaws; jaws are moved in a radial direction by means of bell cranks.

Sleeve is moved by the draw stud which acts through a set of locking blocks. These are inserted in holes in a small inner sleeve and engage an internal taper on the movable sleeve. Locking action is produced by wedging of these blocks against a tapered plug placed inside the sleeve. Tapered plug is one-half that of the movable sleeve so that the blocks are wedged until they are positively released by the draw stud. Tapers are calculated to produce a constant bearing with the blocks for entire movement of the inner sleeve.

When chuck is in gripping position, blocks are initially in parallel contact with movable sleeve and plug. As chuck revolves, centrifugal force on jaws causes locking blocks to rock and exert a maximum locking force.

Logansport Machine Co, Logansport, Ind

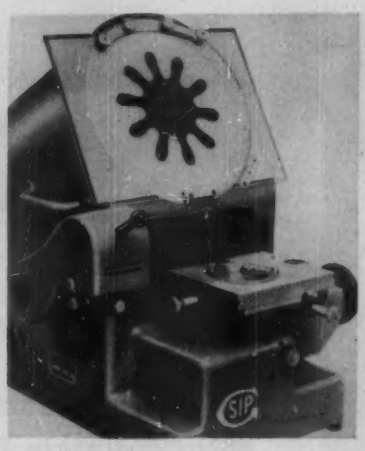


Metal Plan File Available In 5-Drawer Stackable Units

Mayline metal plan file consists of a 5-drawer unit constructed so as to allow stacking in whatever number desired. Units are made in popular sizes in relation to inside drawer space and outside cabinet dimensions. Drawers operate on specially designed ball bearing rollers; positive locking keeps them in position when in use.

Hinged dust cover, made of plastic-coated cotton cloth, is attached to tilting arms which stay in place when raised, and enable operator to use both hands when removing or inserting material in the drawer.

Mayline Co, Sheboygan, Wis



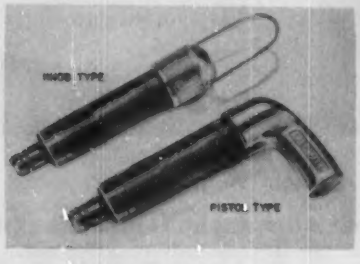
Portable Profile Projector For Small Delicate Parts

Profile projector of relatively small size and light weight can be easily transported. It serves for gaging the silhouette in transmitted light and for inspecting surface of piece by means of incident light. Both types of illumination are derived from one lantern only and can be combined.

The circular screen has a 7⅞-in. dia, is rotatable, and provided with graduations in degrees while vernier permits angular readings to 5 min. of arc. Three magnifications of 10, 20 and 50 are available and guaranteed accurate to 0.001 for diascopic illumination and to 0.0015 in. for episcopic illumination.

The object table, 5½x4¾ in., is provided with cross slides and carries at the center a circular glass stage of 2⅜-in. dia.

Imported by American Sip Corp, 100 E 42nd St, New York 17, NY



Caldwell Air Tool

Air hammer measures 9¾ in. in length and has 1⅝-in. barrel diameter. It is offered in two handle styles, pistol-type and knob-type.

Unit is automatic in that it operates when pressed into contact with work and stops when withdrawn. It operates on pressures from 30 to 100 lb.

Burgess Thomas Co, Dept 3, Box 287, Bloomfield, NJ

THOUSANDS OF WYSONG SHEARS

INSTALLED IN THE PAST 10 YEARS!

There is no better testimonial for the accurate performance and value of Wysong squaring shears than the rapidly growing number of satisfied users.

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Capacities from 18 gauge through 1/4 inch, mild steel. Cutting lengths from 36 inches through 12 feet.

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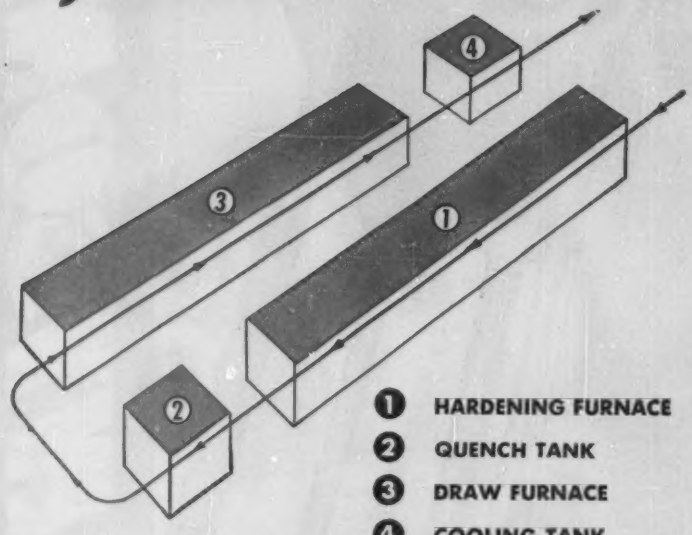
WYSONG

Heat Treat Furnace Layout

by *Holcroft* ...4th of a Series



Automatic Heat Treating Speeds Forging Production

Holcroft developed this automatic furnace unit in order to heat, quench and temper automotive crankshaft forgings.

It consists of a gas-fired hardening furnace, a quench tank, a draw furnace and a cooling tank. So automatic is the production, that a two-man team can handle the entire operation. As a result, the unit contributes materially to trimming production time to a third or even a half of that required by previous methods.

Now, it's entirely possible that this unit costs a little more to install. BUT—a close examination of the cost records indicate savings after savings after savings. Just simple arithmetic proves the economy of a "little more costly" Holcroft furnace. Write today for details. Holcroft & Company, 6545 Epworth Blvd., Detroit 10, Michigan.

BUILT BY HOLCROFT & COMPANY DETROIT, MICH. — PRODUCTION HEAT TREAT FURNACES FOR EVERY PURPOSE

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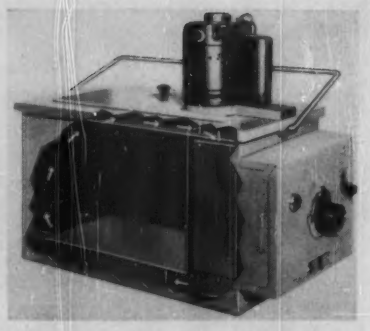
CLEVELAND 15 — Wallace F. Schott, 1900 Euclid Ave.
HOUSTON 1 — R. E. McArdle, 5724 Navigation Blvd.
CANADA — Walker Metal Products, Ltd., Windsor, Ontario
EUROPE — S. O. F. I. M., Paris 8, France



Globe Dipping Tank Is Bench Type

P/S 7 tank offered with or without agitator has 14-lb capacity. With the positive agitation created by the impeller-type agitator, and special heating elements which radiate heat directly to the sides of the tank, more rapid heating and cooling is accomplished.

The tank is equipped with a Robertshaw thermostat which maintains temperature of the plastic automatically. Tests have shown that the tank heats material from room temperature to 360 F in one hour.

Globe Imperial Corp, 2023 Kishwaukee St, Rockford, Ill

Double telescopic mast has been designed for use on Towmotor lift-trucks for extreme lowering for work in low-ceiling areas, or extension in unusually high-stacking areas. Mast permits same truck to be used both for entering and loading or unloading in box-cars and highway trailers, as well as for high-stacking in storage areas. Unit, consisting of two short masts, is available in six different sizes, or preferred mast combinations, varying in lifting height of each, and in total height of lift. Available for Towmotor Models 390, 420, 460, and 480-P.

Towmotor Corp, Cleveland, Ohio

Dextra-lites line includes 17 universally adjustable incandescent and fluorescent lighting units designed for any industrial application. Four models incorporate the Coolite shade, an incandescent hood which remains comfortable to the touch even after long hours of use with a 100-w lamp. Dextra-Lites incorporate the TTC (Turn Tension Control) which enables user to dial exact degree of rotating tension needed to hold unit in desired position when mounting surface is at an angle.

Swivelier Co, Inc, Dept DLP, 43—34 St, Brooklyn 32, NY

Rotary Stock Stop Eliminates Marring

A live head which rotates freely on stock stop during screw machine and turret lathe operation is reported to completely eliminate marring the finished end during stock feed. It is particularly useful in working brass, aluminum and other soft materials. In addition to reducing rejections, elimination of friction between work and stop cuts wear in screw machine mechanisms.

Stock stops are available with plain end or with center hole for a tit on cutoff end of stock. Smaller sizes can be furnished with full-diameter nose, or with small-diameter nose to avoid interference with cross slide tools.

Tools will reportedly withstand hard wear, repeated impact and have no backlash. Oil-hardened steel rotating head is locked into shank and turns on precision bronze bearing. Readily adjustable screw at shank end provides for take-up of end play.

Barnaby Mfg Co, 74 Knowlton St, Bridgeport 8, Conn

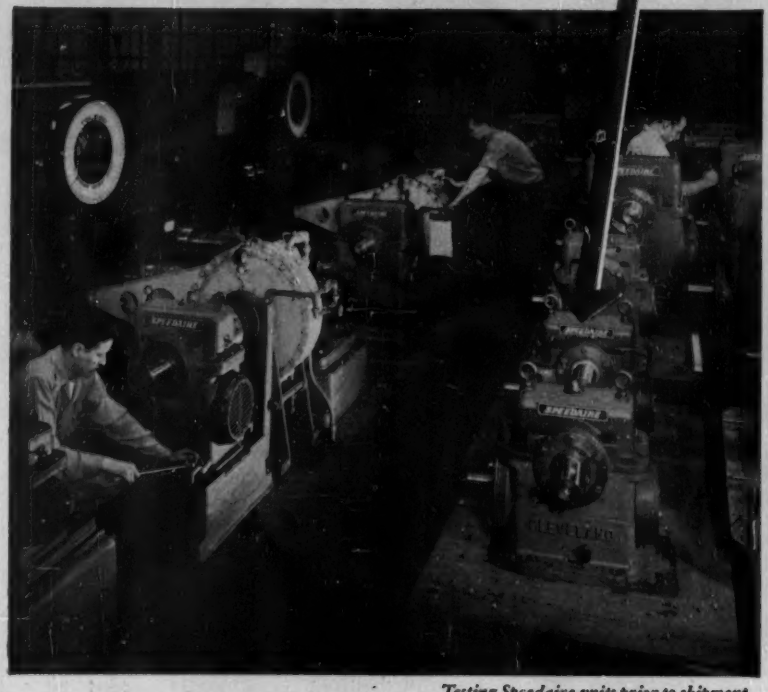
Two series of silencers for quieting the noise produced by air compressors, blowers, vacuum pumps, and other machines expelling high velocity air to atmosphere are available. Series CA and LCA are designed for operation under moisture-free air conditions and for temperatures up to 200 F. CA is available in pipe sizes up to 6 in.; LCA is available in sizes larger than 6 in.

Burgess-Manning Co, Libertyville, Ill

Two Coolie welding electrode holders have inside mechanism suspended in the handle for better ventilation and cool operation. Lightweight holders are available in either straight-nose or offset pug-nose holder types. Both take up to ¼-in. rod. Cable is firmly secured with large ½-in. setscrew or can be solder-attached.

Cam-Lok Div, Empire Products, Inc, PO Box 98, W-3, Cincinnati 36, Ohio

Always with CLEVELAND's SPEEDAIRE you can be sure of...



Testing Speedaire units prior to shipment.

100% pre-testing

ALL Cleveland Speedaire units are pre-tested under *actual job load.* After a test run, each unit is disassembled for thorough inspection of all vital parts. Adjustments, if necessary, are made. Then the unit is tested again. Only when a Speedaire passes this "shake-down" test, is it shipped on to the customer. This 100% check for part perfection and performance under load assures you that every Speedaire you buy is *right and ready* for the job.

The fan-cooled Speedaire unit marks a notable achievement in Cleveland's continuous program of worm gear drive improvement.

SPEEDAIRE IS ECONOMICAL

Speedaire is Cleveland's fan-cooled worm gear speed reducer. Because of the reduction in unit size that their use permits, Speedaire units *cost materially less* per horsepower transmitted.

You'll find full engineering data on Speedaire as well as the complete Cleveland line in Catalog 400. Write today and ask for your free copy. The Cleveland Worm and Gear Co., 3254 E. 80th St., Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.

CLEVELAND Worm Gear Speed Reducers

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Instant Help on Manufacturing Problems

Edited by L. P. ALFORD *and* JOHN R. BANGS. Best experience of scores of industrial firms—to help you plan, organize, engineer, and control production processes in any type industry. 23 sections cover control systems, materials handling, plant layout, machinery, work simplification, etc. *90 Contributors. 1676 pp. 771 ills.* $10

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For Better Personnel and Industrial Relations

Edited by JOHN F. MEE. How to deal with employees, executives, other groups. Complete reference to policies and methods that help you make wise personnel decisions. 20 sections on: personnel programs; job analysis; merit rating; contracts; morale; public relations; the personnel audit; etc. *65 Contributors. 1167 pp., 262 ills.* $10

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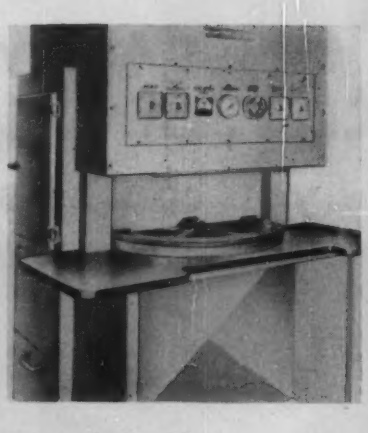

Automatic Wet-Blaster

Cro-Plate has added an automatic model to its line of standard, manually-operated units. The equipment was designed for the elimination of hand filing, grinding, wire brushing, and chemical cleaning of small metal parts.

Operator is seated at front of unit and merely loads and unloads workpieces from rotating table incorporating appropriate workholding fixtures. Cabinet area is divided into three chambers: blast chamber where fixed position guns finish work in part or entirely; rinse chamber where abrasive slurry is rinsed from work; air-dry chamber.

Simple accessible panel contains all necessary controls for operation. Included is a variable-speed table-drive regulator. The only requirement in switching from one type of work to another is the change in workholding fixtures and repositioning of the blast gun.

The Cro-Plate Co, Inc, 747 Windsor St, Hartford, Conn

Integrated Materials Handling System

With the addition of Lamson Mobilift fork trucks to supplement its extensive line of materials handling equipment, Lamson now offers the first integrated system for handling packaged products from the sealing machine through to the shipping platform into trucks or cars or into storage.

Lamson designs and installs conveyors for bringing packaged goods from packaging and sealing machines to an automatic pallet loader. The loader automatically stacks boxes or cartons on pallets in predetermined interlocking patterns and moves the loaded pallet from pallet loader onto storage conveyor. At this point, it is picked up by fork truck and transferred to warehouse.

Lamson Corp, Syracuse, NY

Atlantic

RAKER SET BANDS SAVE YOU TIME... AND MONEY!

Yes, the instant you order Atlantic Raker Set Bands you're in for cleaner, more precise cutting . . . you're dollars and hours ahead . . . you're due for more work per blade than you've ever had before — and here's why!

Raker Set Bands glide through the toughest metals with amazing accuracy — cut true clean through to tolerances as close as .002" — with "finished product" results on job after job.

Atlantic's individually milled, heat hardened teeth and ultra-flexible bands virtually eliminate checks and flaws — prolong band life, slash downtime.

FREE—Send today for the graphic story of Atlantic's family of fine saws. If you have a specific saw application you are wondering about, include a brief description — it will meet with interested engineering attention and be promptly acknowledged.

ATLANTIC

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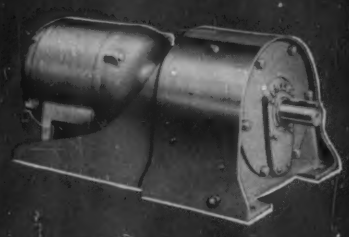
Brewery St. New Haven, Conn.

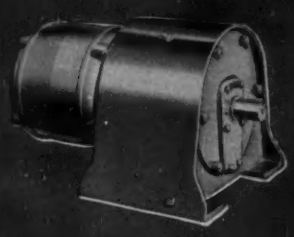
many types, sizes, styles, arrangements...

ALL-STEEL FALK Motoreducers

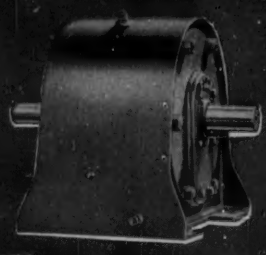
cover the entire application range



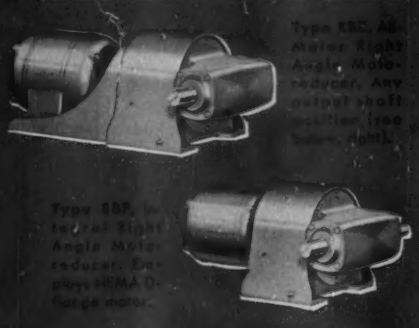
Type EZ. All-Motor Horizontal Motoreducer. Accommodates any make or type of foot-mounted motor.



Type EF. Integral Horizontal Motoreducer. Standard NEMA D-flange motor mounts directly on Motoreducer housing.

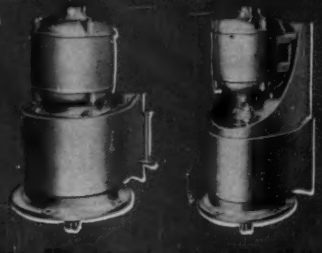


Type EC. Concentric Shaft Speed Reducer. Coupling, chain or belt driven.



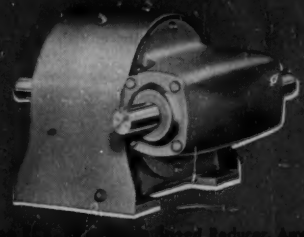
Type EBZ. All-Motor Right Angle Motoreducer. Any output shaft position (see below, right).

Type EBF. Integral Right Angle Motoreducer. Employs NEMA D-flange motor.



Type EFX. Integral Vertical Motoreducer. Employs NEMA D-flange motor.

Type EZX. All-Motor Concentric Motoreducer. For vertical applications.



Type ECB. Concentric Shaft Speed Reducer. Any output shaft position; coupling, chain or belt driven.

VERSATILE MEMBERS OF A DISTINGUISHED FAMILY

The name FALK on a reducing unit of any size or type is your positive guarantee of highest quality, value and efficient performance with minimum maintenance throughout its long life.

All-steel FALK Motoreducers—both the All-Motor and Integral types—are available in horizontal and vertical models with double, triple or quadruple reduction; concentric and right-angle shaft arrangements. They cover a surprisingly wide range in horsepowers and in output speeds. Every FALK Motoreducer is built and rated according to AGMA standards.

Whatever your reduction requirements—be they simple, complex or "different"— it is just good business to consult FALK, recognized leader in the Motoreducer and speed reducer field. Write to Department 247.

Every FALK Motoreducer has these "IN-BUILT" Factors

All-steel Housings. Unbreakable, strong, rigid. Generous overhung load capacities provided by wide bearing spans, large shafts and bearings.

Precision Gearing. Heat-treated alloy steel, precision cut and shaved helical gearing throughout . . . quiet-operating crown shaved pinions . . . taper bored gears for easy ratio changes.

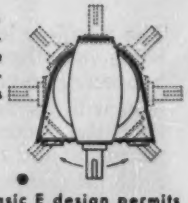
Sealed Housings. Dual closures and one-way vents keep oil in, dust and moisture out. Units are splashproof, leakproof, dustproof.

Wide Speed Range. Selective ratio combinations provide output speeds from 1.5 rpm to 1430 rpm with stock gears.

Streamlined inside and outside. Smooth, clean surfaces; machine welded construction conforms to NEMA motor frames.

Positive Lubrication. Large sump capacity . . . oil-tight construction assures clean lubricant . . . direct dip of revolving elements provides positive lubrication at all speeds.

Any Output Shaft Arrangement (on Right Angle models). Shafts can be furnished in horizontal, vertical or angle position as shown in sketch at right.

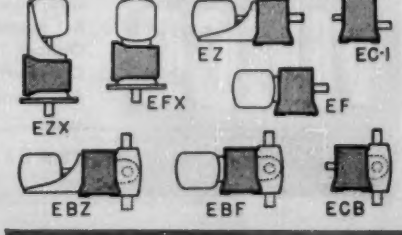


BASIC E DESIGN

EC

• • •

The basic E design permits maximum use of standardized parts . . . closer control over materials, processing, inspection and assembly . . . resulting in faster delivery from interchangeable stocked assemblies.



FALK ...a good name in industry

THE FALK CORPORATION, 3001 W. Canal St., Milwaukee 8, Wis.

WRITE TO DEPARTMENT 247

Vinco Spline Gage Engineers Can Locate and Correct Your Spline Gaging Troubles as Expertly as a Navigator Can Determine a Ship's Position

The needless loss of time and money, caused by splined parts not being interchangeable or failing in operation, is amazing. If this is happening to you, don't hesitate, call in a Vinco spline gage specialist. You will discover, as have so many other successful manufacturers, that the recommended corrective measures will clear up gaging confusion and reduce production, assembly and service problems. Such programs improve quality and reduce costs! In practically every case they have more than paid for themselves—proof that a specialist IS your best bet.

Vinco Corp., 9125 Schaefer Hwy., Detroit 28, Mich.

We'll see you in booth 121 at the A.S.T.E. Exposition

VINCO

MILLIONTHS OF AN INCH FOR SALE

Gear Pumps • Master Gears • Commercial Gears
B-1 Formed Wheel Dressers • Spline Gages
Optical Master Inspection Dividing Heads
Camshaft Comparators • Involute Checkers
Precisiondex • Gear Rolling Inspection Fixtures

TRADEMARK OF DEPENDABILITY ®

Precision Radius Dresser

Radius Dresser, termed the "Little General," was designed to give the machinist perfect feel of the wheel when dressing a radius. Angles tangent to radii can be quickly and easily dressed, radius dimensions rapidly and accurately set, according to the manufacturer.

Range: radius of 0.001 and 0.002 in. up to 9/16 in. Diamond concentricity completely adjustable. Price: $47.50.

General Scientific Corp, 603 N La Brea Ave, Los Angeles, Calif

Airline Lubricator

M-B Products is offering an improved automatic airline lubricator to be used in combination with the M-B Whirl-A-Way automatic airline filter and M-B automatic pressure reducing and regulating valve.

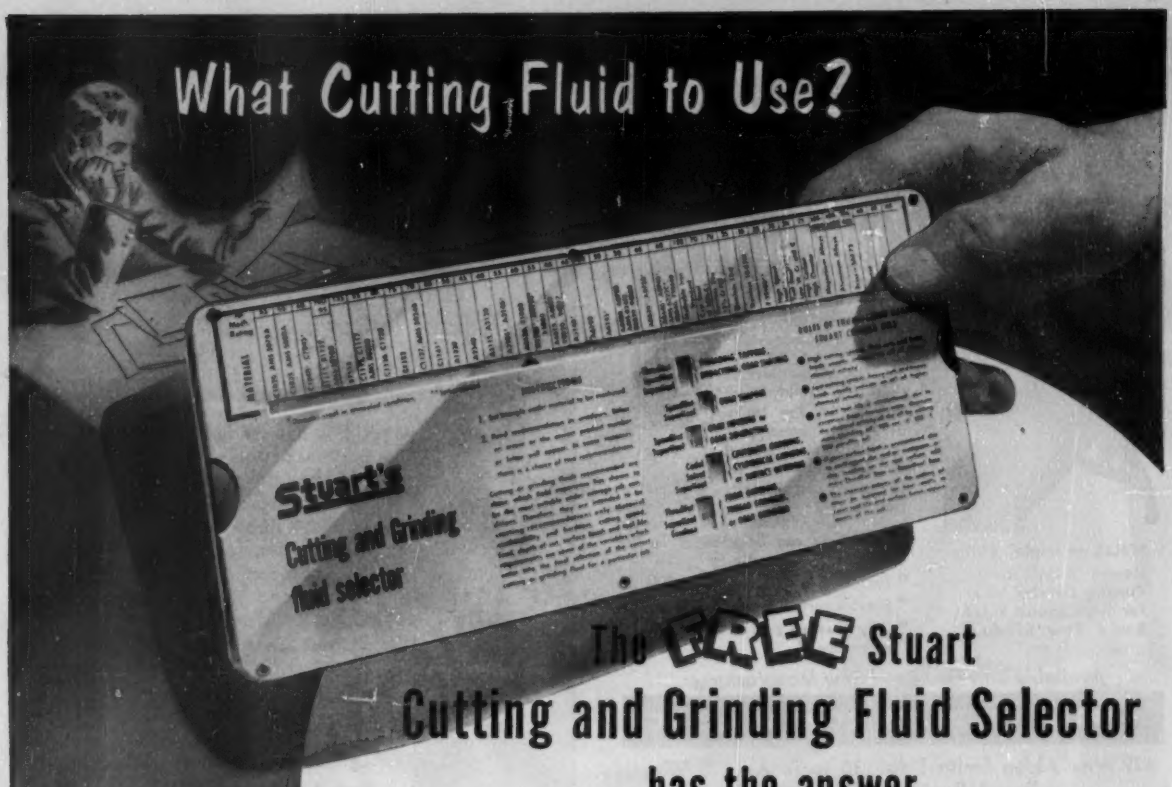
Lubricator has a positive shut-off air without shutting down the airline by closing valves on head. When it is filled it is only necessary to open the shut-off valve and then adjust the flow of oil by the oil-adjusting valve.

M-B Products, 46 Victor Ave, Detroit 3, Mich

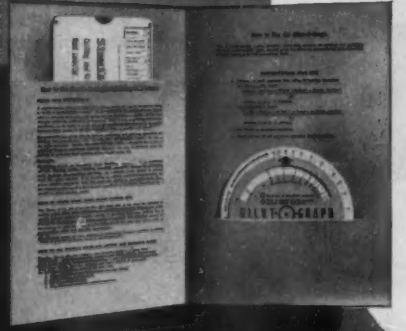
Ace-flex all-purpose, transparent plastic tubing with unusual flexibility, has been developed for temporary or permanent fluid-line application. Product is inert, odorless, non-toxic, and ages well; said to be highly resistant to most inorganic acids and alkalies, and to many organic chemicals. Smooth, shiny, non-tacky finish permits quick and easy cleaning, and it may be steam-sterilized. It is lightweight, abrasion-resistant, and reportedly retains its clear transparency through long life. Can be connected to glass, metal, or plastic fittings simply by dipping in soapy water and slipping over the fitting. Standard sizes are available with inside diameters ranging from 0.120 to 1 in.

American Hard Rubber Co, 93 Worth St, New York 13, NY

What Cutting Fluid to Use?



The FREE Stuart Cutting and Grinding Fluid Selector has the answer



There is a right cutting fluid for every cutting and grinding job . . . and sometimes it's hard to know where to start in selecting one. For that reason Stuart has developed this FREE Cutting and Grinding Fluid Selector. It's a ready reference that recommends cutting and grinding fluids that field experience has shown to be most suitable under average job conditions. In your hand it's a quick guide to starting recommendations for any job. Send for your Stuart Cutting and Grinding Selector today. Remember, more than a "coolant" is needed . . . let the Stuart Selector help you get the right cutting fluid to give you the best results.

Stuart's Cutting and Grinding Fluid Selector and Dilut-O-Graph Folder

This handy folder contains a Stuart Cutting and Grinding Fluid Selector and a Dilut-O-Graph . . . a circular slide rule that makes the diluting of cutting fluids quick and easy. They are double-barreled assurance of having the right cutting fluid on all jobs.

send today

CLIP TO YOUR COMPANY LETTERHEAD AND MAIL

D. A. STUART Oil Co. Ltd.
2729 S. Troy St.
Chicago 23, Ill.

Please send the Stuart Cutting and Grinding Fluid Selector and Dilut-O-Graph Folder.

Name_____

Title_____

☐ Have Stuart Representative Call

More Than a "Coolant" is Needed

D. A. Stuart Oil Co.

TIME-TESTED CUTTING FLUIDS AND LUBRICANTS
2727 S. Troy St., Chicago 23, Ill.
In Canada: Canadian D. A. Stuart Oil Co., Ltd.
3575 Danforth Ave., Toronto

NOW! JIFFY TIRES

STANDARD EQUIPMENT ON Wells METAL CUTTING BAND SAWS

Proof of Acceptance is that this manufacturer has joined the ranks of *leading* band saw manufacturers using CARTER Jiffy Tires as standard equipment because

- *Jiffy Tires can be changed in 10 minutes*
- *Provide 2 to 4 times more wear*
- *Provide perfect traction and balance*
- *Jiffy Tires are safe . . . won't throw at any speed*

WELLS — Model 800 Heavy-Duty, Metal Cutting Cut-Off SAW for High Speed Steel Band Saw Blades.

Available only thru Band Saw Manufacturers

CARTER PRODUCTS COMPANY, INC.

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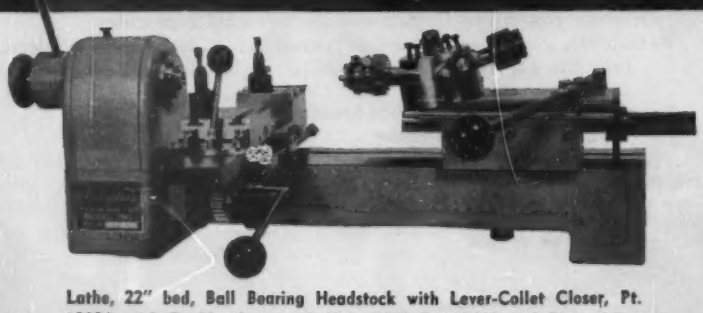
Grand Rapids 2, Michigan

A MODERN TIRE FOR A MODERN SAW

DERBYSHIRE PRECISION LATHE *Model 750*



Lathe, 22" bed, Ball Bearing Headstock with Lever-Collet Closer, Pt. #3804, with Double Compound Slide Rest, Pt. #3652 and Six-position, self-indexing and semi-automatic Turret, Pt. #3610.

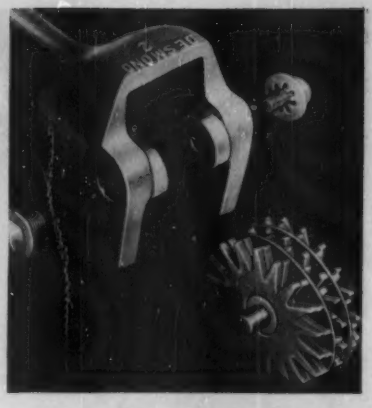
SPECIFICATIONS

Overall Length With Lever Chuck Closer	25"
Length of Bed	22"
Height to Top of Headstock	8½"
Height to Top of Lathe Bed	4"
Width of Bed	2⅞"
Width of Ways	1-13/16"
Swing over Bed	5.905" (15 cm)
Swing over Compound Slide Rest	2¾"
Distance between Centers	12"
Center Height	2.953" (7.50 cm)
Maximum Collet Capacity	.315 (5/16")-(#80 metric)
Maximum Spindle Speed	18,000 RPM
Concentric Running of Ball Bearing Headstock Spindle	.0002"
Spindle Speeds with Variable Speed Drive:	
With Pulley Ratio 1 to 1	600 to 3,000 RPM
With Pulley Ratio 2 to 1	1200 to 10,000 RPM

Delivery from Stock

For full details write:

F. W. DERBYSHIRE, INC.
157 HIGH STREET • WALTHAM, MASS.



GRINDING-WHEEL DRESSER has heavy hardened steel side washers pressed into handle casting to protect from wear of revolving cutters. Hex-head screws, fitted with non-removable lockwashers, securely lock side washers in place and retain cutter pin. Hole in end of dresser handle is provided for fastening dresser to grinder. Dresser is now made to hold cutters of sizes 1, 2, 21, and 22 — *The Desmond-Stephan Mfg Co, Urbana, Ohio*

Leadscrew Tapping Attachment Has Larger Support Arm

Larger support arm for Auto-Tap leadscrew tapping attachments features an adjustable slide which permits 16 to 20-in. round-column drill-presses to be used for leadscrew tapping.

This 500 Series support arm is available in several models to fit different column diameters. Two sizes of support arms are made for Auto-Tap ½-in.-dia, and 1-in.-dia leadscrews, ranging from 80 to 11 pitch for No. 0 to ⅝-in. taps.

Leadscrews for the adjustable support arms are hardened and ground and split nuts are precision-cast and have adjustment for fit and wear takeup. Jacobs rubberflex collet and nut align the tap. Floating lock assembly assures positive drive.

Automatic Methods, Inc, 965 W Grand St, Div 10, Elizabeth, NJ

Combination Filter-Lubricator

CCA Products announces a new combination filter, regulator, and lubricator for compressed air lines. This unit was designed to eliminate complicated piping and fittings required for installation of individual units! Only two connections are required.

Features stated by the manufacturer are: filter provides maximum filtering area; transparent bowl shows when filter is dirty; unit is a

Black & Decker
Cases for Comment

MAINTENANCE
(Case History 8168)
Removing rust fast with wire brush and versatile B&D Portable Grinder

CONSTRUCTION
(Case History 10634)
1616 houses built at 2-a-day rate... thanks to B&D Heavy-Duty Saws

PRODUCTION
(Case History 10691)
20% more production 20% faster...it's a Black & Decker Drill
Photo shows drilling of 10 gauge steel for Victor Furnace. Manufacturer reports use of B&D Drill resulted in 20% speed up, 20% production increase. Drills standing up very well after 8–10 years use...8 hrs. a day...5½ days a week.
Jack-Sure shows long trouble-free service

SMALL DRILLS. Typified by "handful of power" ¼" Heavy-Duty Holgun.* Ideal production tool. Exceptional in "close-corner" drilling.

LARGER DRILLS . . . Models and speeds to fit any job in capacities from ¼" to 1¼" in steel, double in hardwood.

SCREW DRIVERS . . . Drive anything from delicate screws to large nuts and bolts. Many models, positive and adjustable clutches.

SANDERS . . . Drive abrasive discs, wire cup brushes, saucer grinding wheels, other attachments. Four models, 7" and 9" capacities.

BENCH GRINDERS . . . Three models, 6"—10" wheel diams., ¼ to 1 H.P., for sharpening, grinding, wire brushing, buffing.

POLISHERS . . . Clean, polish, seal in *one* operation. Three models including unit with *exclusive* automatic polish feed.

HAMMERS . . . Drive star drills, bull points, etc., in masonry, other materials. Four models, ½" to 2" hole-capacity in concrete.

PORTO-SHEARS* . . . For fast, accurate cutting of ferrous and nonferrous sheet metal. Two models, 12 & 16 gauge capacities in steel.

VALVE SEAT GRINDERS . . . Famous "Vibro-Centric"* action puts a mirror finish on internal combustion engine valve seats in seconds.

PORTABLE GRINDERS . . . Bring the tool to heavy, bulky, hard-to-move work. Perfectly balanced. 3", 5" and 6" wheel diams.

VALVE REFACERS . . . Speedily grind factory-accurate angle on valve faces. Also grind valve stems, tappets and rocker arms for exact clearance.

FACTORY SERVICE . . . A B&D *extra!* Nationwide company-operated branches within 24 hours of *any* customer provide fast, accurate service at reasonable cost!

Industry reports prove . . . for increasing production . . . speedier construction . . . easier maintenance . . . *at lower cost* . . . it's hard to beat Black & Decker Power. They find that in every B&D Portable Electric Tool they get just the right power to do the job.

And they can be sure of getting this right power in B&D Drills, Screw Drivers, Saws, Grinders, etc., because Black & Decker custom builds its own motors. These motors, plus husky housings and precision parts, mean you get a tool that's easy to work with and hard to hurt. In every B&D Tool you have a real time-, trouble-, money-, and manpower-saver.

Want more information? Then ask around your industry . . . your own shop. Call your B&D Distributor for demonstration. And write for your copy of the complete *1954* B&D catalog. Address: THE BLACK & DECKER MFG. CO., 604 Pennsylvania Ave., Towson 4, Maryland.

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B&D Black & Decker
PORTABLE ELECTRIC TOOLS

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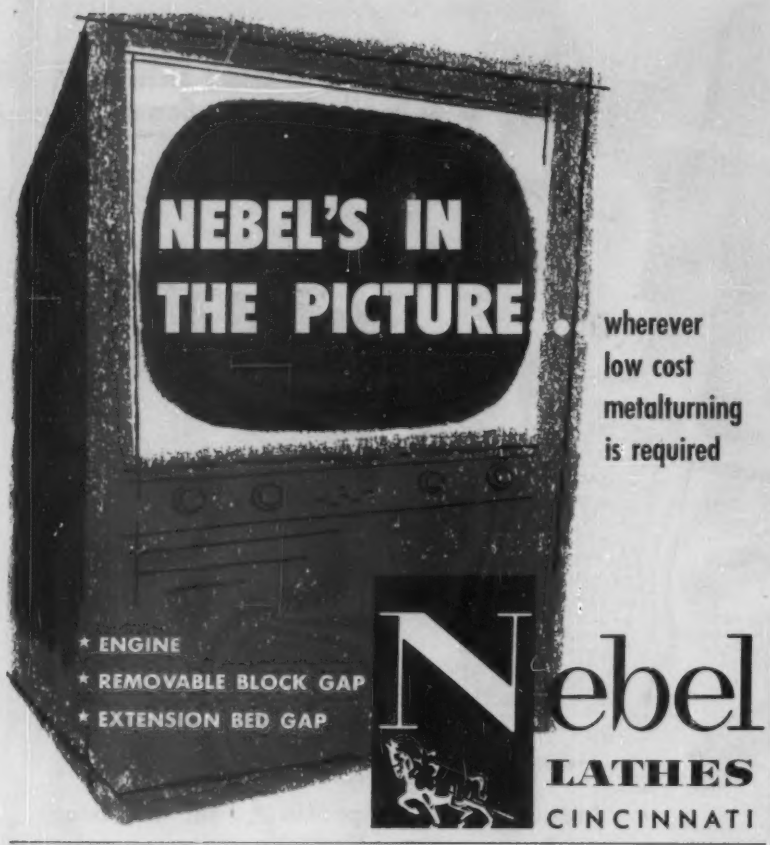


"And so, gentlemen, instead of building the additional plant, we'll just switch to Columbia Tool Steels."

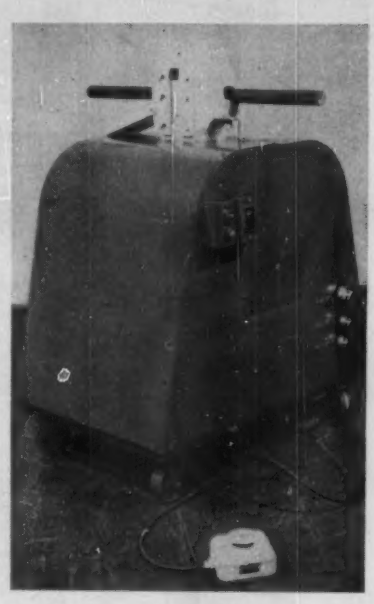
COLUMBIA TOOL STEEL COMPANY • CHICAGO HEIGHTS, ILL.

Producers of fine tool steels — All types immediately available through Sales Offices, Warehouses and Representatives in Principal Cities.

TOOL COLUMBIA STEELS

lubricator, and oil reservoir can be filled without shutting down air line; it regulates pressure—non-diaphragm design provides close control for air-operated equipment requiring 0 to 100 psi in 2-lb increments and 0 to 200 psi in 5-lb. increments; it will bleed steam lines to any required pressure between line and atmosphere; it is a shutoff valve. The new unit is available for pipe sizes from ¼ to ¾ in.

Breco Manufacturing Co, Inc, 309 E Saratoga St, Baltimore 2, Md



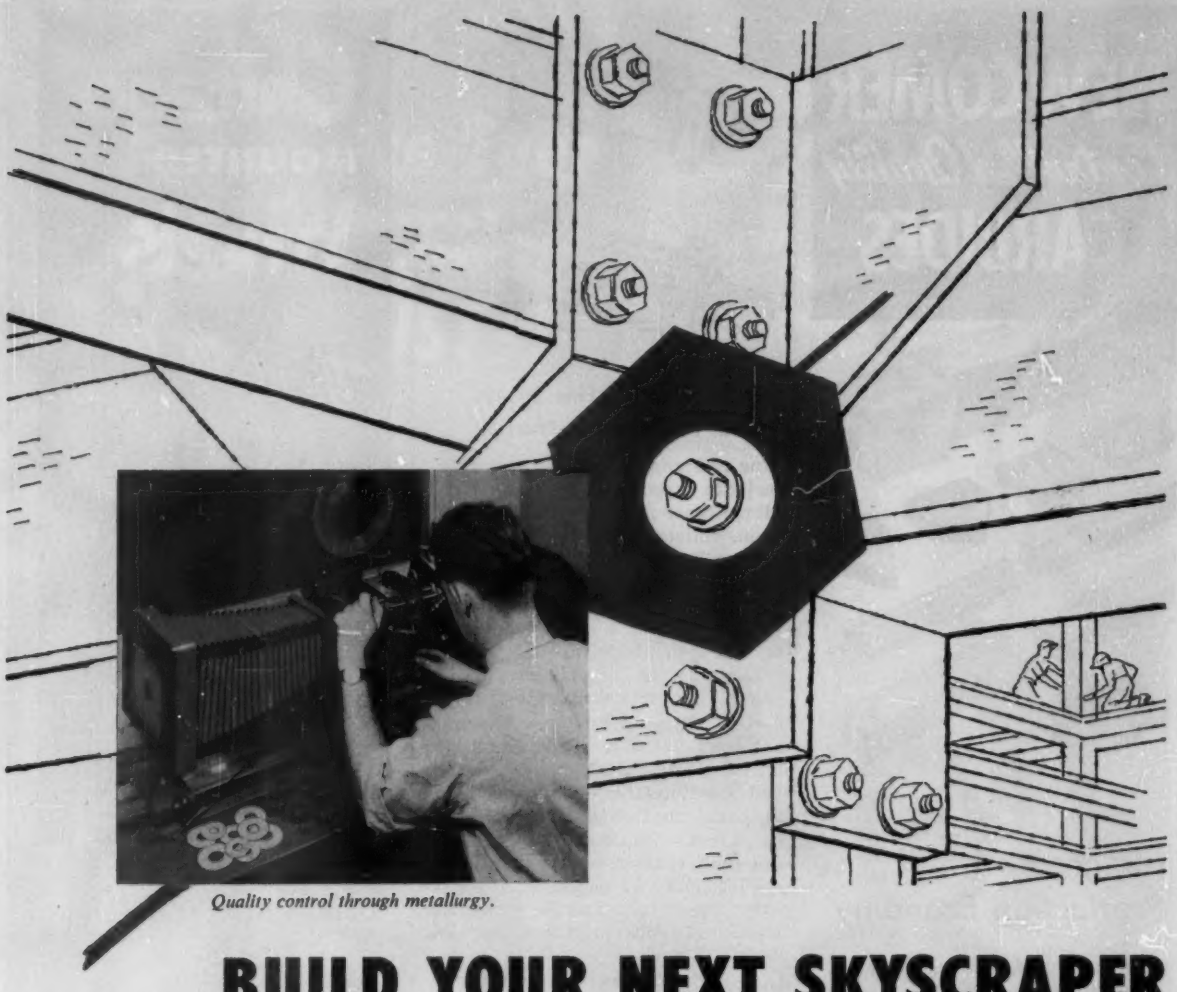
Wheeled Guillotine Takes 1½-in. Alloy Bar

Hydraulic cutter H-90 has 90-ton capacity but weighs only 950 lb. Operation is electric-hydraulic with cutoff time of 2 sec. Interchangeable dies in 1/16-in. increments are available for the compact machine, which is only 48 in. high.

Manco Mfg Co, Bradley, Ill

Abolite lamp reflectors with all-white titanium porcelain enamel finish are said to provide a surface that floods more brilliant light to provide maximum efficiency. Glass-smooth finish is said to be resistant to weather, chemical, and oil fumes. Ventilator slots provide for air to automatically circulate around the lamp and through slots to keep dust and grime on the move and prevent settling; design is said to provide 7% more up-light; all reflectors accommodating 200-w lamps or over can be supplied with ventilator slots at no extra cost.

Abolite Lighting Div, Jones Metal Products Co, West Lafayette, Ohio



Quality control through metallurgy.

BUILD YOUR NEXT SKYSCRAPER WITH HEAT TREATED WASHERS

This is the framework for a skyscraper. It's put together with high strength, *heat treated* bolts, nuts and washers—almost like a king-size Erector set.

There are other methods of erecting structures.. riveting or welding. But many of America's leading engineers favor the "high tensile strength bolt" method.

Why is bolting preferred? First, high-strength bolted joints are stronger.

Second, they are easier, less costly and safer to install.

Third, they require little if any maintenance.

Fourth, they eliminate the noise of riveting.

Where does Lindberg Steel Treating Company get into the act? Ours is simply a supporting role. We heat treat the steel washers.. carloads of them for the U. S. Steel Supply division* of United States Steel Corporation.

Lindberg Steel Treating Company is equipped to handle your production heat treating, too. Giant heat treating furnaces.. skilled heat treaters are at your command. What do you make.. forgings, castings, wire products, fasteners, springs, wrenches, pins and bushings? Whatever it is, and whatever your volume.. ten thousand or ten million.. call Lindberg Steel Treating Company.

Heat treaters: *Have you written for your copy of the "condensed tempering chart"? It's a finger tip guide to the tempering of practically all types of steels. Available without charge.*

**Through Wrought Washer Manufacturing Co., Milwaukee, Wisconsin*

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FIllmore 4-4080

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GEnesee 5212

ST. LOUIS
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Fireside 6200

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2910 So. Sunol Drive
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A case history of Lindberg Steel Treating Co. service to American industry

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NEWCOMER CARBIDES are made to give you greater production economy through heavier feeds, faster cutting speeds and greater wear resistance than most other carbides. Complete stocks of standard carbide blanks, cutting tools, and mechanically-held tools are available for ready delivery.

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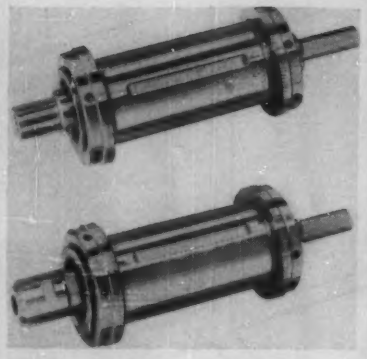


Standard Spindle Line Speeds Special Machine Construction

Line of standard spindle assemblies includes types to fit No. O or No. 1 Morse taper shanks with ⅛, 3/16 or ¼-in. collets. Drills, reamers, taps, ends mills and other tools of similar size can be accommodated. Overall dimensions of spindle assemblies run from 4⅝ in. to 8 in. in length and form 1⅝ to 2½ in. in dia.

Longitudinal adjustment of the spindle is provided by nuts at either end of the quill housing. The nuts are graduated in increments of 0.0005 in. Single row ball bearings at either end are standard; double row bearings can be furnished. Keyway is machined in quill housing for locking it in casting where spindle assembly is to be mounted. Spindle drive mechanism can be set up by attaching pulley to protruding back end of spindle.

Russell T Gilman, Inc, 2410 N Farwell Ave, Milwaukee 11, Wis

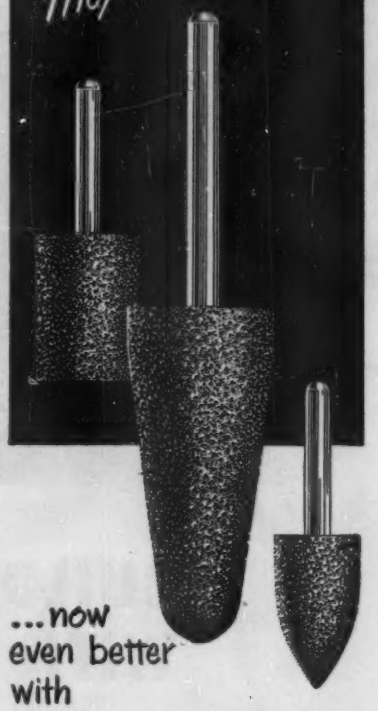
Sandwich-design panels, with variety of uses ranging from desk-tops to catwalks, consist of two outer sheets of embossed aluminum bonded with heat and pressure to a core made from resin-impregnated paper formed into a figure-eight honeycomb construction. Manufactured in standard thicknesses ranging from one to four inches, panels are claimed to be unusually strong and rigid in relation to extreme light weight, and to have excellent thermal and acoustical insulation qualities. Material, called Reynocell, is available in sizes up to 57 in. by 16 ft.

Reynolds Metals Co, 2500 S Third St, Louisville, Ky

Plastic Templets

Custom-made plastic templets are reported capable of reducing the time spent on repeat drawings of parts requiring duplication as much as

Chicago MOUNTED Wheels
They're the Best



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the new miracle grinding wheel bond

Choose Chicago Mounted Wheels — bonded with 79E Bond — and you'll never buy any other! This tough new grinding wheel bond, exclusive with Chicago Wheel, has taken the industrial world virtually by storm, doing a better grinding, burring and finishing job faster. Greatest selection of sizes and shapes for every application. Best of all, deliveries are good . . . ready when you need them. Try 79E Bond Mounted Wheels.

WRITE today for full information and literature. It's free.

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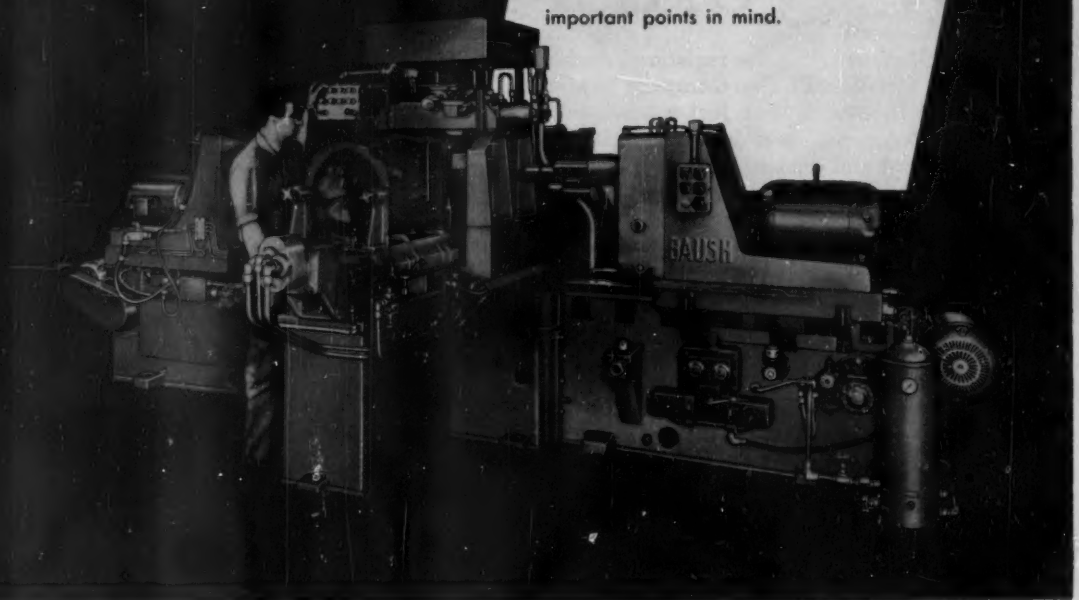
OFFICES IN PRINCIPAL INDUSTRIAL CENTERS

Machine Tool Modernization is a MUST!!

HOW ABOUT YOUR EQUIPMENT?
Does it meet today's demands for low cost, high speed production?

Every Baush Machine Tool — from a single-operation multi-spindle tapper or drilling machine, to multi-station transfer lineups — is designed specifically for YOUR JOB with these two important points in mind.



Note the compact efficiency of this Baush 3-Way Horizontal Multi-spindle drill illustrated.

Designed to counterbore, chamfer, ream and spotface rear end as well as left hand and right hand sides of a heavy tractor transmission case, this machine consists of

1 — 30F — 18T Hydraulic unit
2 — 30F — 18 Hydraulic units
1 — 11 spindle F.C.Head for rear unit
1 — 8 spindle F.C.Head for left hand unit
1 — 8 spindle F.C.Head for right hand unit
1 Holding Fixture

Production: 35 parts per hour at 100% efficiency. "Baush" has meant Machine Tool Quality for more than 60 years because Baush has kept abreast of modern demands in their design and construction.

WHY NOT USE THIS EXPERIENCE WHEN YOU NEED MODERN MACHINE TOOLS? Wire, 'phone, or write us NOW.

BAUSH
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SPRINGFIELD 7, MASSACHUSETTS

an ACCO product

ACCO Registered* WIRE ROPE SLINGS

A STANDARD OF QUALITY

●"ACCO *Registered*" is the registered trademark applied by American Chain and Cable Company to slings of the highest grade, but it is more than just a trademark.

"ACCO *Registered*" is a definite specification of quality in both material and design.

To be "ACCO *Registered*," a wire rope sling must meet the following specifications:

1. **It must be made from high strength "Green Strand" wire rope.**
2. **All parts of the finished sling must have a breaking strength equal to the catalog strength of the sling body.**
3. **All fittings and attachments must withstand a proof-test equal to at least two times the rated capacity without permanent distortion.**
4. **Actual field service tests of each design.**

As evidence of compliance with these requirements each sling is given a metal identification tag and is accompanied by a Certificate of Proof Test and Registry.

What does ACCO REGISTRY mean to you?

It means that you can equip your shop with "lifting tools" and be confident that their designs and materials are specifically selected for the highest efficiency by trained engineers who spend all their time on slings.

It means that you can be sure that your men, materials, and machines are given the highest protection against injury during lifting operations.

Where can you get ACCO REGISTERED SLINGS?

To make ACCO *Registered* Slings immediately available for your requirements, American Chain and Cable Company, Inc. has appointed one of the best industrial supply houses in your community as an ACCO *Registered* Sling distributor. Selection for such appointment is made on the basis of the distributor's desire to serve you, his grasp of your problems, and his willingness to maintain in his stock sizes and types of slings you need.

See your ACCO *Registered* Distributor or write to us for literature and his name.

*Trademark Registered

ACCO

TRADE MARK

Wire Rope Sling Department

AMERICAN CHAIN & CABLE

Wilkes-Barre, Pa., Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

75%. Reason for this is the great variance from plant to plant in shapes and forms of elements which require duplication. All Hermes templets are made according to specifications from original blueprints cut in 0.30 Plexiglas with a 15° bevel for tracing pencil.

Hermes Engravers, Inc, 13 University Place, New York 3, NY

Close-Quarter Work Done With Flat-Angle Drill

Air-powered drill has head height of 43/64 in. and 5/16-in. spindle offset, over-all length of 10-5/16 in. Bevel gears were relocated at rear end of housing to decrease size at drilling end. In addition, heavy-duty bevel gears instead of small delicate ones were used.

Ductile cast iron has been used in the right-angle assembly. It compares with strong malleable iron, yet has the added advantage of bending characteristics. Cover plate is also new, of heat-treated alloy steel with graphitic features.

Models are available with speeds of 1450, 2100, 2500, and 4000 rpm; threaded spindle accommodates threaded drill bits. Small external collets are available for numbered drill sizes up to and including ¼ in.

The Aro Equipment Corp, Bryan, Ohio

Portable Bench Center

Acme bench center weighs 19½ lb and has an over-all length of 18 in. with a known flat surface accurately machined and checked within 0.0005-in. max. It is designed to accommodate magnetic or standard indicators directly on the bed area.

Unit easily sets on angle plates and fits any 12-in. surface plate. It is made to hold pieces up to 13 in. long with a swing up to 5 in. Indicator holders are also available.

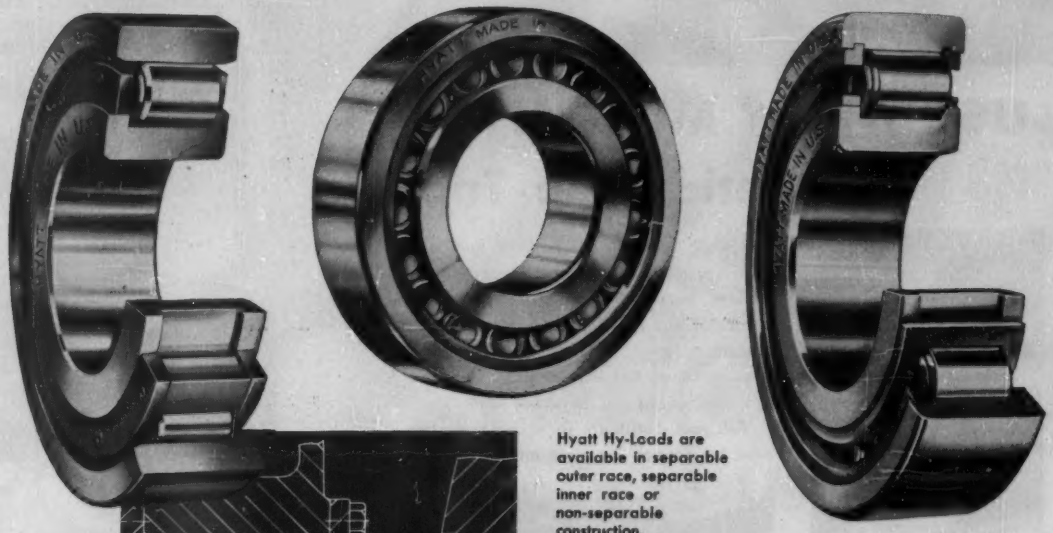
Acme Industrial Co, 200 N Laflin St, Chicago 7, Ill

High Speed Counting For Industrial Control

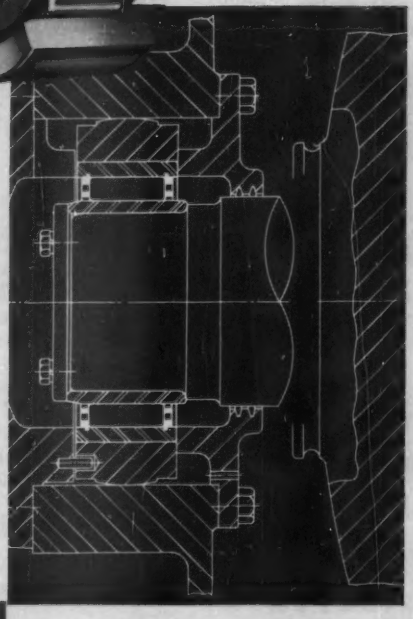
Production processes that involve continuous unit flow, or any movement that can be measured by an electrical device or mechanical pick-

Is shaft expansion a problem?

HERE'S HOW HYATTS HELP...



Hyatt Hy-Loads are available in separable outer race, separable inner race or non-separable construction.



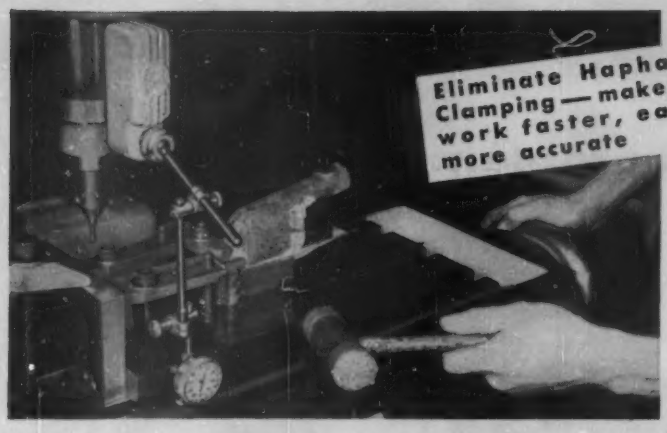
Check the drawing at the left. The bearing is a Hyatt Hy-Load, and because the inner race is cylindrical, the shaft it supports is free to move axially—thus allowing for shaft expansion without cramping the bearing or distorting the shaft. Obviously, this is only one of many ways in which Hyatt bearings can be used to reduce costs as they reduce friction, but it's a good example of why so many designers throughout industry keep their Hyatt catalogs within easy reach.

For further details write for Catalog 150 or call your nearest Hyatt representative.

HYATT ROLLER BEARINGS

STRAIGHT BARREL TAPER

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION • HARRISON, NEW JERSEY



USE LUFKIN MITI-MITE Magnetic Base Tools

Light exactly where you need it.

Six basic Miti-Mite tools with hundreds of shop applications include Indicator Holders in 2 sizes, Handi-Lites in two sizes, a 4-Power Magnifier and a Portable De-magnetizer. Permanent magnets in bases attach instantly to any round or flat iron or steel surface. All are engineered for accuracy and long life.

Ask your distributor for a demonstration, or mail the coupon for more information.

4-Power Magnifier is invaluable for inspection, precision drilling, etc.

Special shoe attachment permits Indicator Holder to be used on surface plates.

Compactly designed portable De-magnetizer can be used in hard-to-reach places.

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Send Today for Free MITI-MITE Booklet

THE LUFKIN RULE CO., Dept. AM, Saginaw, Mich.

Please send me your free Miti-Mite booklet describing magnetic base tools.

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Address_____

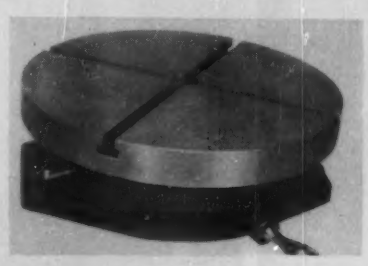
City_____ State_____

301

up may be monitored by this preset counter at speeds up to 5000 counts per second. The all-electronic unit, Model 164, is designed for industrial applications in controlling automatic machinery and processes over a wide range of rates or operating speeds. At the instant that a predetermined value of count is reached, the instrument provides an electric closure. This may be applied to start, stop, divert, modify, or measure a continuous process flow, operate an alarm, record a batch, bring in an auxiliary process function, or otherwise provide conclusive action.

Recycling at the instant the predetermined count is reached may be automatic or by independent control. The counter can be said to respond to input impulses of either polarity and any voltage between 4 and 60.

Atomic Instrument Co, 84 Mass Ave, Cambridge 39, Mass



Cam-Locking Rotary Table

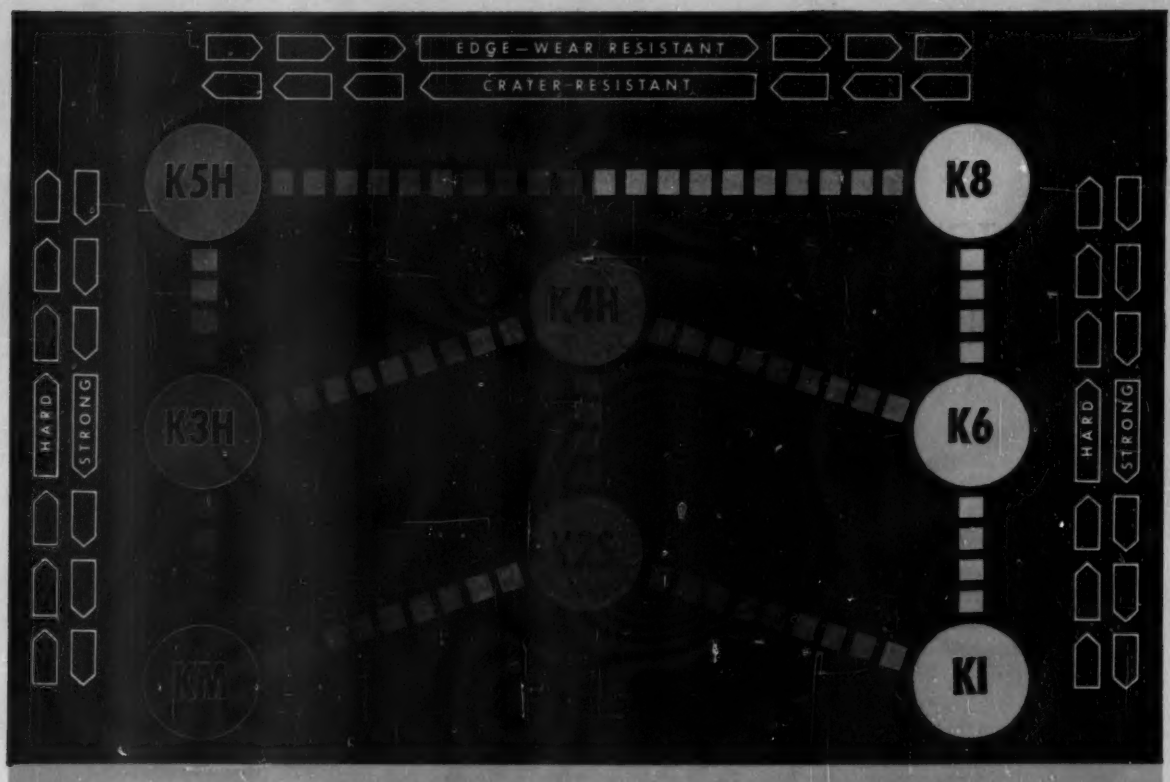
Troyke cam-locking rotary table is intended for quick manual rotation for use in assemblies and subassemblies. Table can support a substantial weight and can be locked in any position. It can be used for all assembly operations of small and medium-sized parts.

Table is hand-scraped on two bearing surfaces to fit the cast-iron base. Locking of table is accomplished by quick-action cams. Center bearing is adjustable to take up any wear. Periphery of table can be graduated in degrees and quickly positioned for any angular movement.

Troyke Mfg Co, 4422 Appleton St, Cincinnati 9, Ohio

Reed Special Forming Machines For Joggling and Offsetting

Machines are used for joggling or offsetting end of tank shells and pipes for subsequent assembly of welding heads. Joint produced provides excellent back-up for automatic welds and facilitates assembly. Turntable permits rotation of work; also rotating work end-to-end, and move-



NOW! A Quick, *Easy-to-Use* Guide to Efficient Machining

Here's the first simplified system for selecting carbide tool grades. Kennametal's new grade selection method assures top tool performance on every machining job. It's easy to use and eliminates guesswork because grades are grouped according to their wear characteristics (edge-wear and crater-resistant); also according to relative strength with strong, intermediate and hard grades included in each group. These eight Kennametal grades meet all machining requirements.

Kennametal's grading system is unmatched in the industry for simplicity. Any experienced machinist can use it to quickly adjust grades for better tool performance. For example: If K3H is being used and crater is no problem, a switch to K4H, which is more edge-wear resistant, will provide longer tool life. Conversely, if K4H is being used and crater is excessive, a switch to K3H would improve tool life.

Your Kennametal representative will gladly help you apply this grade selection system to your machining operations. He can also help apply these eight grades to "wear spots" in your product, your processing lines, or any place a hard, wear-resistant metal is needed. Just give him a call. Kennametal Inc., Latrobe, Pa.

* Registered Trade Marks

Learn WHY

"IT PAYS TO BE A GOOD TOOL DETECTIVE"

"It Pays to Be a Good Tool Detective" will be the topic for Wednesday, April 28, at 9:00 A.M., at the Carbide Seminar. Kennametal engineers will discuss selection of proper grades, feeds, speeds, depth of cut, clues to tool trouble, and solutions.

The Carbide Seminar, sponsored by ASTE, will be held at the University of Pennsylvania's Towne School, near the Convention Hall.

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KENNAMETAL
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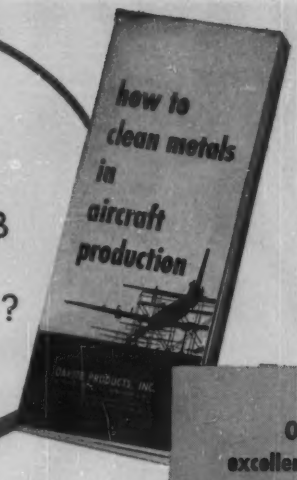
A-15

SALES OFFICES IN PRINCIPAL CITIES

WHAT IS YOUR TOUGHEST CLEANING JOB IN AIRCRAFT PRODUCTION?



¶ **That's** hard to answer, isn't it? Maybe it's hard to remove smut from one alloy; no problem with other alloys. One drawing compound may harden into all kinds of trouble; others may wash away in a wink. ¶ **But,** whether it's an oxide or a weld flux or a stencil mark or a synthetic enamel that gives you a headache today, your Oakite Technical Service Representative is pretty sure to be able to help you laugh it off tomorrow. ¶ **Several** of our customers helped us make a list of jobs on which we could give them the most help. The table at the right shows these jobs in order of volume rather than toughness. There is some overlapping in the listings and some of the jobs – like machining, grinding, forming and preventing corrosion – are not strictly cleaning jobs. But every one is a job for which we have a material or a method that may be worth a lot of money to you. ¶ **You** may not agree with the ranking of these jobs. But a glance at the list may stimulate your ideas about improving some of your operations. If you'll circle in the coupon the numbers of the jobs that interest you, we'll be glad to tell you about Oakite materials designed for your work.

FREE Our 48-page illustrated booklet *"How to Clean Metals in Aircraft Production"* contains information on all the cleaning jobs in the list.

Oakite has excellent materials for all these jobs:

1. Cleaning aluminum
2. Stripping paint with solvent strippers
3. Stripping paint from steel (hot tank)
4. Machining and grinding
5. Deoxidizing aluminum
6. Steam cleaning aluminum
7. Steam cleaning steel
8. Deflocculating paint in spray booths
9. Metal forming
10. Stripping paint from aluminum (hot tank)
11. Removing corrosion and preparing for painting
12. Descaling
13. Preventing corrosion
14. Cleaning magnesium
15. Electrocleaning steel
16. Barrel finishing
17. Plant maintenance cleaning and sanitizing

OAKITE PRODUCTS, INC., 24 Rector St., New York 6, N. Y.

Send me a FREE copy of your booklet *"How to Clean Metals in Aircraft Production."*
I especially wish to obtain better results in the jobs indicated by the numbers circled below:

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	

NAME _____

COMPANY _____

ADDRESS _____

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OAKITE
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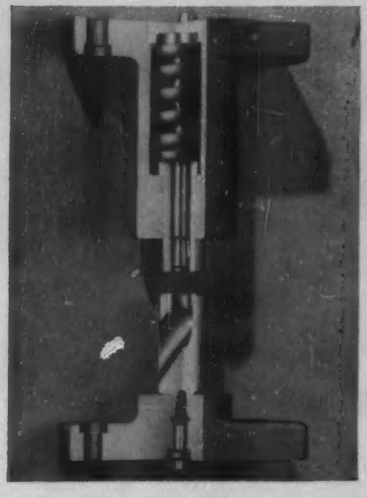
Technical Service Representatives in Principal Cities of U. S. and Canada

ment of work into and out of machine. Machine is offered in three models, capacity of ¼, ⅜, and ½ in.

Reed Engineering Co, 1003 West Fairview Ave, Carthage, Mo



Hole-Punching Units For Unlimited Setups

Type JD hole-punching units are designed to punch mild steel up to ¼ in. thick and may be used and reused in unlimited setups. Each punch and die assembly is independent and self-contained. The punch assembly consists of holder, punch, stripping spring, punch guide, and pilot head. The die assembly consists of holder, die, and pilot pin.

Assemblies are mounted in die sets and operate in press the same way as conventional dies. Units may be mounted directly to standard flat surface die sets, or on templets mounted into die sets. By using templet-mounting method, changing setups requires removing from press pair of operating templets and replacing them with next complete setup.

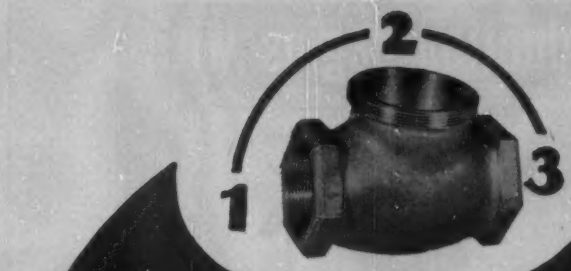
Units are available in two holder sizes to punch round or shaped holes up to ⅞ in. in dia.

Wales Strippit Corp, 345 Payne Ave, North Tonawanda, NY

Parts Cleaning Machine Uses Tray Agitator

Industrial washing machine agitates a tray, holding the parts, through the cleaning bath which is generally a solvent-type material. Unit is loaded at normal working level, and parts are moved directly from plant conveyor to table-height-tray of machine.

At loading position, tray is raised

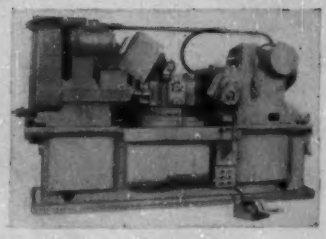


...and parts are finished without rehandling on

GOSS & DeLEEUW AUTOMATIC CHUCKING MACHINES

The Goss & DeLeeuw "One-Two-Three" Chucker differs from the conventional machine in that it provides the means of machining more than one end of a piece in a single handling instead of requiring several handlings and set-ups. A worthwhile gain in production time is assured.

In the "1-2-3", work is gripped in chuck and all ends machined either in sequence or simultaneously. Goss & DeLeeuw and only Goss & DeLeeuw offers this feature in a standard chucking machine.



A few typical parts finished on this machine are shown here. Write for detailed description . . . send samples of your work for time and cost estimates.

GOSS & DeLEEUW
QUALITY · PRODUCT · QUANTITY

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

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Get production off to a profitable start! Use Columbus Die-Tool engineered tools. Jigs, Fixtures, and Special Machinery individually designed and built to produce your product alone . . . at a rate to match your production schedule. That's production economy! That's the wisdom of CDT special machinery! That's how Columbus Die-Tool can put your production on a profitable basis. Columbus Die-Tool are specialists in building special tools, jigs, fixtures and machinery . . . have been for over 46 years. Talk over your special problems with us. Absolutely no obligation. Write today.

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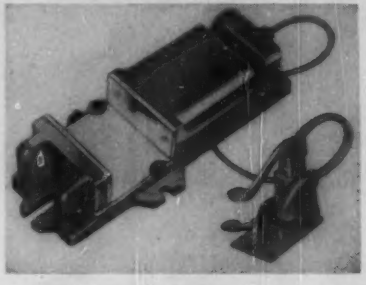
ESTABLISHED 1906

Manufacturers of
JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE
SPECIAL TOOLS • UNITS FOR MACHINE TOOLS

to top of tank out of cleaning solution. After loading, operator presses a button which starts the machine. The tray sinks into tank to operating level where it is agitated at the rate of 40 spm. At the end of the cleaning period tray is raised to loading position again. Pneumatic mechanism is only moving part; it operates at 100 psi.

Tank can be operated cold or heated with steam, gas, oil, or electricity. Temperature control is provided to hold tank temperature at any point between 80 and 212 F. Parts tray is designed for max load of 400 lb.

The Cincinnati Cleaning and Finishing Machinery Co, Sharonville, Ohio



Studebaker Milling Vise Uses Hydraulic Pressure

Milvise holds work with hydraulic pressure from a few pounds to 5 tons; pressure is obtained by foot-operator equipped with applicator pedal that moves rear jaw forward to grip work, while another pedal applies pressure to max and the third breaks pressure-jaw automatically.

Construction is of steel; jaw plates are hardenend and ground. Jaw faces are aligned parallel within 0.001 in. Cross slots and side cars are provided so vise can be bolted lengthwise or across work table.

Length is 20⅜ in.; width 8⅝ in.; height 7 in.

Studebaker Machine Co, 1221 S 9th Ave, Maywood, Ill

Griptite finish provided on non-allergic Neoprene industrial gloves provides a permanent rough-finished glove that can be used safely in handling the most delicate materials because of the absence of abrasive particles in the construction. Finish, in addition to being impervious to foreign matter, will not peel or chip off during entire lifetime of gloves. Regular glove is available in light, medium, and heavy-weight style, ranging in lengths from 10½ in. to 18 in. Turn-cuff model, available in both medium and heavy weight style with lengths of 12 in. and 16

Improved CLEVELAND *High Speed* COUNTERBORES

New Flute Design for More Efficient Chip Removal

Deeper flutes eliminate "packing" of chips and reduce tool breakage . . . enable you to counterbore the full length of the flutes. This *superior tool* also gives you the *economy* of interchangeable pilots. It requires no holders or adapters. ◈ A test will prove the outstanding features of these improved CLEVELAND Counterbores.

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150 SQ. IN. OF WORK SURFACE

ABRASIVE NO. 1½ TOOLROOM SURFACE GRINDER—a quality-built hand feed grinder—has the capacity your toolmakers need for their work—nearly 50% more than most small surface grinders. Abrasive No. 1½ is easy to work with—it's a big favorite with toolmakers throughout the world. Thousands of these simple, efficient grinders are in service today—in tool and die shops, and in the tool departments of production plants. Send for Catalog giving complete details. Abrasive Machine Tool Company, 8 Dunellen Road, East Providence 14, R. I.

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ACCURACY BOOSTS PRODUCTION

Abrasive Quality is Reflected in the Finish of Your Product

in., when turned up, forms a trough which keeps liquids from dribbling down or trickling inside the glove when wearer is reaching for high spots.

Surety Rubber Co, Carrollton, Ohio

Digital Magnetic Tape Handler

Model 902 digital tape handler will start and stop in time of 5 milliseconds and tape speeds up to 60 ips. Extension of available tape width to ⅝ in. permits up to eight channels of information to be recorded simultaneously. Another important feature is the complete interchangeability of tape from one machine to another.

Servo-controlled reel drive systems ensure lower tape tensions for longer recording head life and longer tape life. Choice of 30/15 and 60/15 ips dual speeds with ¼, ½, and ⅝-in. tape is provided. The 60-ips handlers use 8-in. reels with 1200-ft capacity. All models of design for standard NAB hubs.

Standard 19-in. rack mounting is used. Power requirements are 400 watts at 115 v, 60 cycles.

Potter Instrument Co, Inc, 115 Cutter Mill Road, Great Neck, NY

Industrial adhesive, requiring only fingertip pressure to join materials together, will permanently fasten rubber, metals, wood, plastics, ceramics, or fibers together in any combination. Liquid adhesive reportedly resists attack by salts, alkalis acids, moisture, or solvents which might affect bonding quality of ordinary industrial cements. Force of 10,000 psi would be required to pull apart any two metals joined together by the cement, according to the manufacturers.

Cycleweld Products Div, Chrysler Corp, Detroit 31, Mich

Metaseal Impregnating System for Porous Metals

Packaged system for impregnation of porous metals uses a method based on polyester resins and a vacuum pressure cycle.

Model 1-24-L, and Model 1-36-L for larger production requirements, come installed with complete line of necessary equipment—impregnating tank, cleaning and rinse tanks, reservoir, vacuum pump, vapor trap, valves, gages, and pipes. The impregnant, Metaseal 19V5, does not require refrigeration, agitation, or

In a four month period under actual competitive conditions one Diamond Wheel ground 36,976 pieces, while eight silicon carbide wheels ground a total 16,023 pieces.

RESULT— 1. Less cost per piece 2. Greater Production 3. Less down time.

See for yourself how

SECOMET DIAMOND WHEELS

can provide you with these plus values

Send for informative catalog #54 or contact us direct for information and assistance.

J. K. SMIT & SONS, INC.

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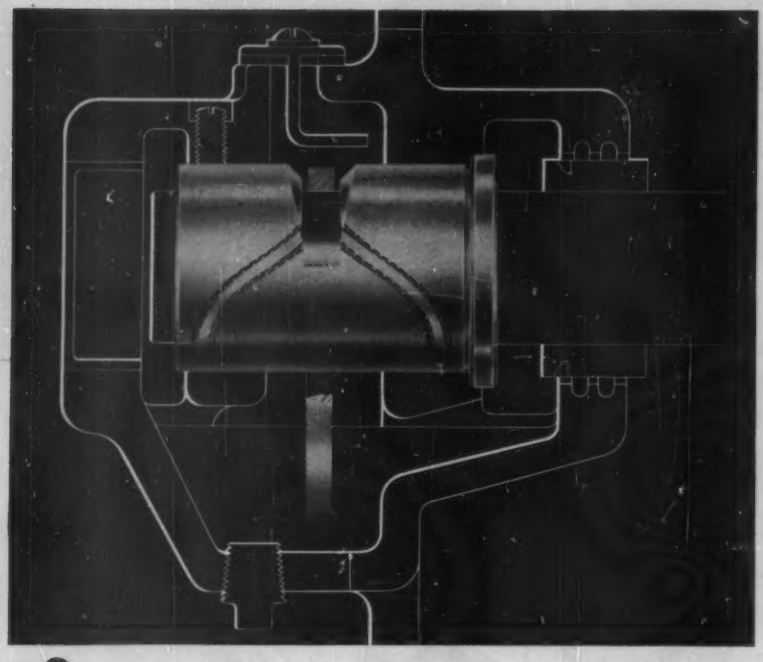
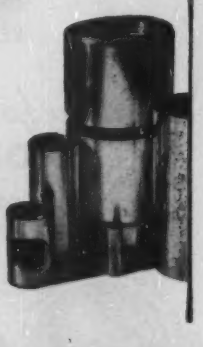


THE WAY TO CUT...

Cost of surrounding design

Although the sleeve bearing is longer than other types it is also much smaller in outside diameter. The weight of parts required to support bearings varies directly as the length of the bearing but it also varies directly as the *square* of the outside diameter of the bearing. Therefore the use of bearing types which are large in diameter and short in length frequently results in the use of surrounding parts which are unnecessarily heavy. Since unnecessary weight costs unnecessary dollars, consider the sleeve bearing not only for its own initial low cost but because of the possibility of reducing the weight and therefore the cost of the surrounding parts.

There is a Bunting Engineer near you. Consult him. Or send your inquiries direct to our Product Engineering Department at Toledo.



Bunting.

BRONZE BEARINGS • BUSHINGS • PRECISION BRONZE BARS

The Bunting Brass & Bronze Company • Toledo 1, Ohio

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aeration, and is reported to maintain constant viscosity at the ideal value required for castings. It resists a wide variety of chemicals, solvents, fuels, and lubricants.

In Metaseal's batch-impression process, castings are placed in a sealed chamber and evacuated to remove all air from the pores. Without breaking the vacuum the impregnant is introduced into the chamber under pressure. After a half hour casting, surfaces are washed with Metaclean and then cured by the Metacure process.

American Metaseal Mfg Corp, West New York, NJ

Warning System

Automatic alarm system enhances the efficiency of magnetic separators by virtually eliminating possibility of human error. Magnalarm insures against product contamination, machinery damage, and even fire and explosion, by automatically removing the cause—tramp iron and ferrous particles in the production line.

A sensitive ferrometer constantly measures the quantity of tramp iron as it accumulates on the magnet's surface and reacts on a circuit to trip the alarm as soon as a predetermined accumulation is reached. Standard types of alarms are optional, as is the location of the alarm.

The permanent magnetic separators derive their powerful force from castings of Alnico V metal, the magnetic strength of which is guaranteed for life. Being non-electric, the unit requires no wiring, no connections, and a minimum of maintenance.

Eriez Manufacturing Co, Dept MC 3, Erie, Pa

Tiny-titan No. 150 heavy-duty duplex magnetic base holder instantly mounts test indicators up to 3 in. in dia to flat or down to ¾ in. round with a 125 lb pull. Swivel adapter allows full 360° adjustment in all directions. Price, $15.50 complete, including 3-step universal rod, offset clamp for lug back indicators, swivel adapter and adapter for stud indicators.

Enco Mfg Co, 4520-26 West Fullerton Ave, Chicago 35, Ill

Free-Machining Die Steel

Olympic FM is a free-machining high-carbon high-chromium die steel of the air-hardening type. It is said to cut machining time as much as 50% without affecting physical properties

Your nut running costs can be reduced with APEX hand-driver-and-socket combinations

On production line or in maintenance work, Apex hand-driver-and-socket combinations will help reduce the cost of manual nut running operations. A single Apex hand driver will accommodate a full range of Apex impact quality sockets to drive hex head nuts. Sockets are quickly and easily interchanged to meet job requirements instantly . . . less time and effort is needed . . . your small tools inventory can be kept to a minimum.

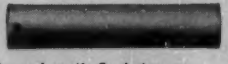
Apex hand driver, Superloid handle, ¼" male square drive, pin lock. Available with ball lock.

Apex hand driver, wood handle, ¼" male square drive, pin lock. Available with ball lock.

FOR RUNNING HEX NUTS

For spinning, fastening or removing hex head nuts, bolts, pal nuts, etc., any of these Apex sockets may be used in cost-cutting combination with an Apex hand driver. Sockets are of impact quality, cold broached and heat-treated for extended service.

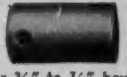
Tapered—for 3/16" to 9/32" hex nuts.
Straight—for 3/16" to ½" hex nuts.



Extra Long Length Sockets
Tapered—for ¼" to 9/32" hex nuts.
Straight—for 3/16" to 5/16" hex nuts.

TO DRIVE SHEET METAL SCREWS

These impact quality Apex sockets are case-hardened for use on sheet metal screws, hardened and commercial cap screws. ¼" female square drives, for use with Apex hand drivers illustrated.



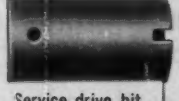
Tapered — for 3/16" to 7/32" hex head screws.
Straight — for ¼" to 7/16" hex head screws.

You can reduce screw driving costs, too! with APEX hand-driver-and-bit combinations

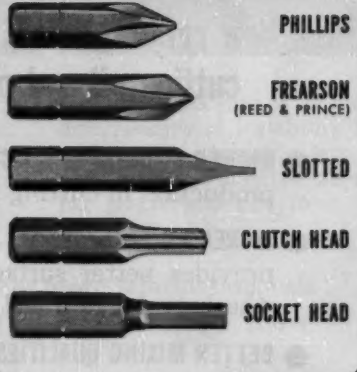
For economy and efficiency on manual screwdriving operations, choose an Apex hand-driver-and-bit combination. Driver accommodates service drive bit holder which takes a full range of Apex insert bits to drive Phillips, Frearson (Reed & Prince), Slotted, Clutch Head and Socket Head Screws. Bits are easily interchanged in the holder, may be economically discarded when worn. Hand drivers and holders last indefinitely, reducing original equipment costs.

Catalog 21

56 pages of time- and- money-saving Apex tools for every screwdriving job. Write, on your company letterhead, please, for your copy.



Service drive bit holder, ¼" fem. sq. drive for ¼" hex shank bits. Available for ¼" square shank bits.



APEX TOOLS

hand drivers, impact sockets, insert bits

THE APEX MACHINE & TOOL COMPANY
1026 S. Patterson Blvd., Dayton 2, Ohio

CUTTING. New S.E.C.O. keeps parts and tools cooler. Tools last longer, require fewer grindings; production is increased; finishes are uniformly good.

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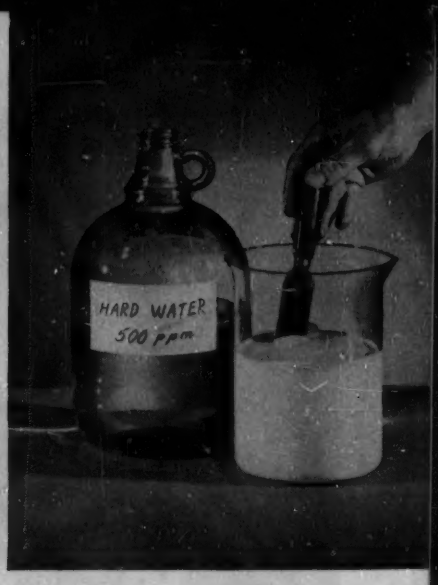
Sunoco Emulsifying Cutting Oil

New refining facilities improve industry's most widely used cutting oil and permit it to give these added benefits

- **HIGHER MACHINING EFFICIENCY**—better finishes, longer tool life, increased production in cutting operations
- **INCREASED DETERGENCY**—particularly important in grinding operations—provides better surface finishes, prevents loading and glazing of the wheel, prolongs wheel life
- **BETTER MIXING QUALITIES**—in hot, cold or hard water
- **A PURER, CLEANER CUTTING OIL**—whiter, more stable emulsions; cleaner parts and machines; better operator acceptance
- **EASIER HANDLING**—pumps from storage tanks more readily, flows from drums faster
- **GREATER VERSATILITY**—can be used for rolling, washing and rustproofing as well as cutting and grinding

MIXES BETTER IN HOT WATER. New S.E.C.O. mixes and remains stable even at 180 F. This permits its use in washing and rustproofing.

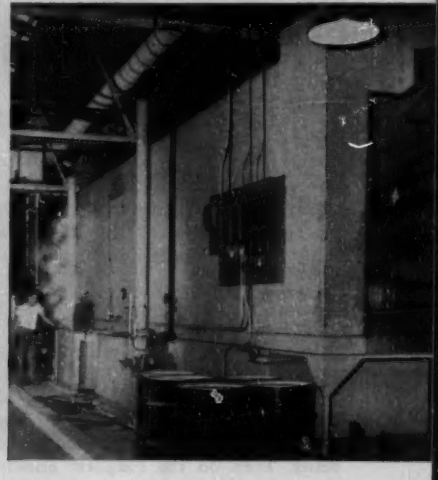
MIXES EASILY IN COLD WATER. New S.E.C.O. forms stable emulsions in the coldest water . . . even ice water does not affect it.



MIXES READILY IN HARD WATER. New S.E.C.O. eliminates the need for special hard-water grades of emulsifying cutting oil.

GRINDING. New S.E.C.O. improves surface finishes because its increased detergency prevents loading and glazing of grinding wheels, prolongs wheel life.

RUSTPROOFING. New S.E.C.O. is a better hot rustproofing medium. It forms stable emulsions, coats metal parts uniformly, protects them against rusting.



WASHING. Because of its increased detergency and its ability to mix and remain stable in hot water, New S.E.C.O. is better for removing grease and dirt from metals.

TEST THIS NEW S.E.C.O. IN YOUR OWN PLANT. For more information, call your nearest Sun office or write SUN OIL COMPANY, Phila. 3, Pa., Dept. AM-4.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

SUNOCO®

PHILADELPHIA 3, PA. • SUN OIL COMPANY LTD., TORONTO & MONTREAL

Made by the producers of famous Blue Sunoco Gasoline and Dynalube Motor Oils

Now...another new Atlantic abrasive

NU-TEX

..ready to cut finishing costs to a new low!

Check these time and money-saving advantages now . . . see for yourself how Nu-Tex "Cushion Cut" Disk Wheels can help you boost production, keep operating costs low.

FASTER, SMOOTHER CUTTING ROUGHING AND GRINDING

Designed for use on portable or bench grinders, new flexible Nu-Tex Disk Wheels feature a special built-in resiliency that provides a smooth, cushioned cutting action . . . makes finishing faster, easier. Even on the roughest grinding jobs, Nu-Tex cushioned cutting eliminates bouncing . . . holds the wheel in contact with work . . . distributes pressure evenly and smoothly. With a Nu-Tex Wheel, every inch of surface travel is an inch of productive cutting.

LONGER LIFE . . . LESS DOWNTIME

Bonded together with a special, extremely tough resin, durable, textile-reinforced Nu-Tex Wheels provide a greater margin of on-the-job safety . . . last longer under continuous operation . . . assure maximum protection against breakage. Atlantic quality control assures a uniform, high grade performance from every wheel you buy.

WIDE SELECTION . . . PROMPT SERVICE

Nu-Tex Depressed Center and Straight Disk Wheels are available in popular diameters and thicknesses for all types of finishing. Grades range from 0 (hard) to 6 (soft).

Choose from the complete Nu-Tex line . . . get prompt service on every order. Write for descriptive literature or, if you prefer, have a Nu-Tex Abrasive Engineer show you these new disk wheels in action — saving time and money on the job!

ATLANTIC ABRASIVE CORP.

MAIL THIS COUPON TODAY

Atlantic Abrasive Corp., 516 Pearl Street, South Braintree 85, Mass.

☐ Please send me descriptive literature ☐ Please have Nu-Tex Abrasive Engineer call

Name_____

Company_____

Street_____

City_____ State_____

or changing heat treatment.

In tests made on Olympic FM and regular hot-rolled annealed bars 3-in. dia x 18 in., using HSS cutting tools, feed, 0.009 in. per rev, depth of cut, 0.062 in., results obtained proved that for a 60-minute tool life, cutting speed for regular Olympic was 30 fpm and 60 fpm for the free-machining grade.

Latrobe Steel Co, Latrobe, Pa

Electroplating Rectifiers

Line of electroplating rectifiers accommodates any application requiring positive source of continuously smooth dc current at capacities from 5 to 50,000 amps.

They are available in five basic models: 2000 to 50,000 amps; water cooled, 1500 to 50,000 amps; small package, 250 to 2000 amps; cubicle, to 2000 amps; bench type 5 to 200 amps.

Units are three-phase selenium-type rectifier stacks connected for 5% ripple. They can be connected in series, parallel or series-parallel for practically any output of dc power.

Wagner Bros, Inc, 400 Midland Ave, Detroit 3, Mich

Dual-purpose respirator, with twin cartridges for organic vapors or filters for dust, has a face-piece of soft rubber to provide leak-proof fit with light tension on two adjustable headbands. No. 99 respirator for organic vapors has twin 85cc cartridges with inhale and exhale check valves to prevent rebreathing. No. 96 respirator for dusts has twin-treated wool-felt filters with high filtration factor. Filters from both respirators 99 and 96 are quickly replaced from the front.

Chicago Eye Shield Co, 2300 Warren Blvd, Chicago 12, Ill

Swinging clamp attachment, which can reach out to either side of a narrow aisle to grasp or tier loads behind material already stacked, is now available for use with all gas and electric-powered Carloader models of fork-lift trucks manufactured by Clark Equipment. While unit can also be adapted for heavier machines, maximum capacity for attachment is 600 lb, regardless of truck capacity; this is due to the side stability problem inherent in a long, overhanging boom. Clamp device has a full 180° traverse; is readily detachable and interchangeable with other standard attachments.

Clark Equipment Co, Industrial Truck Div, Battle Creek, Mich

ROUND TABLE Discussion

FOREMAN OR CLERK?

To what extent should a foreman be tied down by paper work? Does so-called red tape slow up normal production overseeing, or will it in the long run avoid duplication of orders and lost time in emergencies?

IF BUSINESS IS getting so cockeyed as to make a clerk out of a foreman, then, in order to regain its eyesight, we'll have to make a foreman out of the clerk because there must be someone available to look after the men.

We certainly cannot let a bunch of highly paid mechanics roam around like a crowd of high-school kids or they'll be eating popsicles and drinking soda on the company's time. This may seem rather far-fetched but, surprising to some people, workers have to be watched, directed, and sometimes driven to perform useful work. If the foreman is going to spend his time burrowing beneath a pile of supposedly useful forms and whatnot, how in hell is he going to perform his duties as a supervisor?

Fifteen minutes a day is sufficient for any foreman to have to attend to such paper work—even that is rather costly because it may happen that his vigilance had dropped at a time when he should have had his eyes on something very important. If he spends more than that amount of time on such clerical work he certainly will be neglecting the men in his department and in so doing he is neglecting the interest of the firm.

"I know they're paying big money in the auto plants, but it's so much trouble teaching those big corporations my way of doing things."

Bay State Taps produce threads of the utmost precision with a maximum of productivity. This dual quality of Bay State Taps . . . precision performance . . . is readily available from nearby shelves of industrial supply distributors.

BAY STATE TAPS

BAY STATE TAP & DIE COMPANY | MANSFIELD, MASS.

benchmaster
Koil Kradle
with new electronic time delay!

Automatically maintains any desired length of slack loop from which machine can draw! No adjustments— no operator attention.

features:

AUTOMATICALLY FEEDS ALL TYPES OF COILED MATERIALS—wire or strip—to punch presses, shears, slitters, forming rolls, etc.

SUPPLIES STOCK ONLY AS MACHINE NEEDS IT—Unit runs continuously without actuating bar or automatically using actuating bar and electronic time delay to maintain a slack loop.

VARIABLE TIME DELAY—Provides a shut-off delay after motor switch is tripped. A slack loop of predetermined length is then formed from which forming machine can draw.

ADJUSTABLE WIDTH CONTROL—Reel space is quickly adjusted to accommodate varying roll widths by rotating a crank. Steel guide plate is moved laterally by three lead screws, simultaneously driven by roller chain.

REVERSIBLE MOTOR—Operates in either direction for feeding or rewinding stock. Reversing switch is supplied as standard equipment.

EASY LOADING—Slack loop actuating bar lifts up, exposing entire reel area. Coils are rolled up ramp, eliminating all lifting.

4 POWER DRIVEN ROLLS, linked by roller chain insure positive reel drive. Rolls are hardened for maximum life and polished.

HEAVY-DUTY FLANGED NEEDLE BEARINGS—Power rolls and back-stop roll are mounted in heavy duty flanged cast iron pillow blocks, each equipped with roller type needle bearings for long life and trouble-free operation. Alemite fittings permit easy lubrication.

TOP ROLLER STOCK GUIDE—Adjustable vertically, prevents kinking of material. Plastic roll minimizes possibility of marking material.

ACTUATOR BAR equipped with plastic roll for preventing surface marking of material.

THE BENCHMASTER KOIL KRADLE is designed to fulfill a wide variety of feeding problems. It automatically supplies a slack loop of material permitting any machine to draw from the slack loop rather than against the weight of the coil. Material fed over the actuating bar triggers a micro-switch as the slack loop tightens. The powered rolls then rotate the coil, forming a new slack loop.

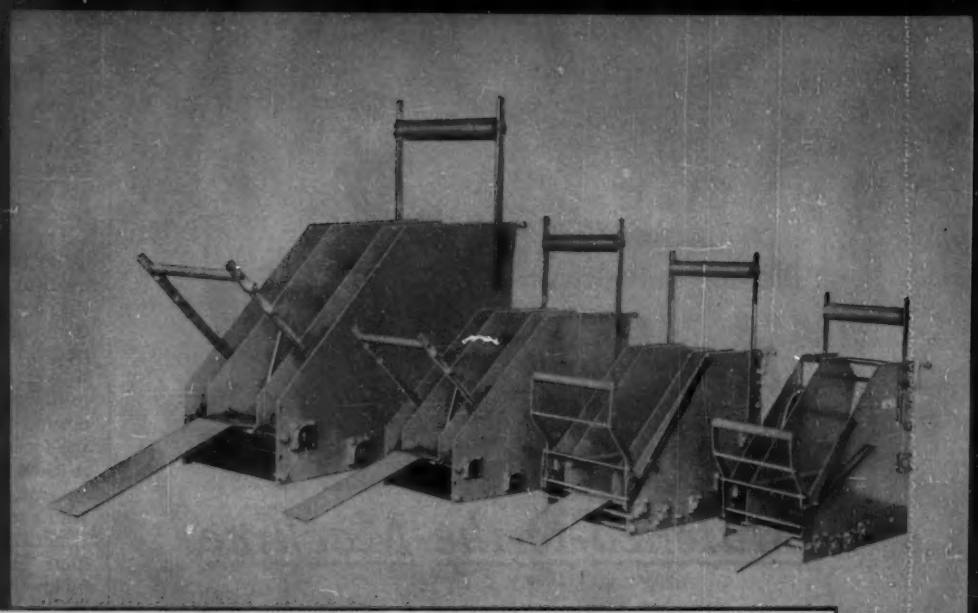
VARIABLE ELECTRONIC TIME DELAY—This new, exclusive time delay eliminates constant starting and stopping of the feed motor. It keeps the powered rolls turning for any desired duration up to 10 seconds *after* the actuator bar trips off the micro-switch. Forms a new slack loop, reduces motor stops and starts, insures longer cradle life!

See your dealer or contact Benchmaster Manufacturing Company 1835 West Rosecrans Avenue, Gardena, California

benchmaster

World's largest manufacturer of small punch presses and mills.

benchmaster Koil Kradle SPECIFICATIONS



	Max. Reel Wgt.	Max. Stock O.D.	Stock Width Adjustment	Rate of Feed	Power Rolls	Special Rolls	Guide Plate Rolls	Motor	Reversing Switch	Floor Space	Net weight approx.
300 SERIES Model 310—10" Stock width Model 313—13" Stock width Model 315—15" Stock width Extra stock widths over 15" available at additional cost	1200 lbs.	36"	Single adjustable guide plate	90 f.p.m. standard. Optional speed: 130 f.p.m. (No extra charge)	Hardened and polished	Hardened Eccentric or Knurled Rolls available at extra cost	Hardened stock guide rolls available at extra cost	½ h.p. single phase 60 cycle 110 V A.C.	Standard equipment no extra cost	15"x32" 18"x32" 20"x32"	310 lbs.
400 SERIES Model 410—10" Stock width Model 413—13" Stock width Model 415—15" Stock width Extra stock widths over 15" available at additional cost	2000 lbs.	42"	Double guide plates. Individual adjustment on each.	90 f.p.m. standard. Optional speed: 150 f.p.m. (No extra charge)	Hardened and polished	Hardened Eccentric or Knurled Rolls available at extra cost	Hardened stock guide rolls available at extra cost	½ h.p. single phase 110 V A.C. 3 phase 220 or 440 V extra cost	Standard equipment no extra cost	16"x32" 19"x32" 21"x32"	425 lbs.
500 SERIES Model 515—15" Stock width Model 518—18" Stock width Model 520—20" Stock width Extra stock widths over 20" available at additional cost	3000 lbs.	48"	Double guide plates. Individual adjustment on each.	90 f.p.m. standard. Optional speed: 150 f.p.m. (No extra charge)	Hardened and polished	Hardened Eccentric or Knurled Rolls available at extra cost	Hardened stock guide rolls standard equipment	¾ h.p. 3 phase 60 cycle 220 or 440 V A.C. Motor controls standard equipment	Standard equipment no extra cost	25"x45" 28"x45" 30"x45"	740 lbs.
600 SERIES Model 620—20" Stock width Model 624—24" Stock width Model 628—28" Stock width Extra stock widths over 28" available at additional cost.	4000 lbs.	60"	Double guide plates. Individual adjustment on each.	Variable Speed Drive 25-100 f.p.m.	Hardened and polished	Hardened Eccentric or Knurled Rolls available at extra cost	Hardened stock guide rolls standard equipment	1 h.p. 3 phase 60 cycle 220 or 440 V A.C. Motor controls standard equipment	Standard equipment no extra cost	30"x67" 34"x67" 38"x67"	1600 lbs.
700 SERIES	This series is made to order for requirements not met by 600 series. Send data for recommendations.										

Model 810—for 10" Koil Kradles
813—for 13" Koil Kradles
815—for 15" Koil Kradles
818—for 18" Koil Kradles
820—for 20" Koil Kradles

benchmaster pinch rolls

SERIES 800

Benchmaster Pinch Rolls are used as attachments on the KOIL KRADLES to aid the feeding of all types of troublesome materials between .010" and .150", i.e.:

THIN AND THICK STOCKS, OILY STOCKS, SPRING TEMPERED STOCKS, LAMINATION STOCKS, STOCKS WITH SLITTING CAMBER AND STOCKS FED FROM EGG SHAPED COILS.

When the Pinch Rolls are used in conjunction with the KOIL KRADLE the power rolls in the cradle help to start the coil rotating, overcoming inertia and minimizing surface marking of the stock by the pinch rolls.

EASY INSTALLATION—Factory installed or installed in the field as an accessory in hour.

EASY LOADING—A Benchmaster KOIL KRADLE equipped with a pinch roll can be loaded in 1½ minutes.

BOTH ROLLS POWERED—Top and bottom rolls are both chain-driven from the KOIL KRADLE power rolls, insuring synchronism and overcoming all tendency to coast independently after power is shut-off.

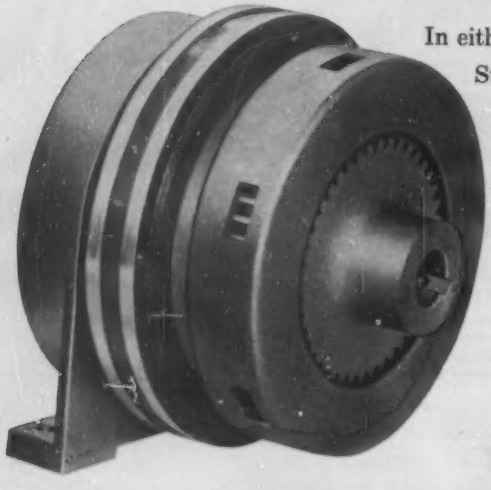
Be Sure with a

Matched-to-the-Machine

STEARNS MAGNETIC CLUTCH

On many machines, a standard magnetic clutch does the job.

On others, however, a special custom-made unit is needed for the most profitable results.



In either case, you're right with Stearns — because this pioneer in magnetic equipment builds both.

Here are important reasons why Stearns magnetic clutches provide positive dependable control on such a wide variety of applications.

- *Torque range from .4 to 30,000 lb. ft.*
- *Low inertia — fast, smooth engage and disengage. Split shaft, through shaft, two speed drives, forward and reversing drives — other special applications.*
- *Quiet and cool running. No metal-to-metal contact, no sparking.*
- *Automatic or manual control.*
- *No toggles, yokes, shifters.*
- *Simple adjustment.*

Let Stearns' design and engineering experience work for you. Consult your Sweet's Product Design File or write for bulletin 226-C-2.

1683

MAGNETIC EQUIPMENT FOR ALL INDUSTRY

STEARNS MAGNETS

STEARNS MAGNETIC, INC. 700 S. 28th St., Milwaukee 46, Wis.

With the advancements made in modern business procedure there has been dumped in the executive's lap voluminous amounts of forms: questionnaires in duplicate—usually in quadruplicate—one copy (pink) to go to personnel; a green one to the medical adviser; the yellow copy to the secretary of the Chamber of Commerce; and the blue one he is to keep in his files so that he can look it over when he hasn't got anything to do. While the workers wander around like a bunch of lost sheep, the foreman has to ponder over Form A-69973592-Y in order to satisfy the yearnings of the pay master who wants to know why Skinny Murphey is entitled to a raise of two cents an hour. After he has filled in a satisfactory explanation he sends the checkered one to the paymaster; the brown one to personnel; and the other one he keeps so as to check himself at some future date so that he won't make a liar out of himself.

Then we have the most important form: the inter-departmental communications sheet with the self-contained carbon backs. The foreman takes pride in mulling over this so that he may express himself in terms suitable to the other person's understanding. A copy of this must go to the manager who wants to keep his fingers on every phase of the business; one to the superintendent who is interested in knowing what it is all about; and the next to the last copy—the one with the three holes punched in the upper left corner—goes to the production department. If he fails to keep a copy for himself, he's likely to doublecross himself at some future date so one has to go to his personal file.

Well, I haven't touched the surface yet and still he is called on the carpet to explain briefly why order number 395006284 hadn't been delivered on the date set by some jackass who had no sense of time.

Foreman or clerk! Foreman or jerk is more appropriate. I know what it is to have to toady to some of these swayback hay-burners with the long ears who delight in lying awake nights thinking up new ways and means of aiding business—aiding business to the downward path because of lack of foresight in paying more attention to the frills than to the vital things so necessary to economical production. What I think of some of these pinheads who insist upon a highly-paid executive performing work that is more suitable to the low-priced underdog is perhaps better left unsaid.

Jack Everett
San Francisco, Calif

A GOOD FOREMAN is entirely too busy to be expected to make out many orders and requisitions—that is clerical work, and it should be done by a clerk. The foreman, however, should certainly read everything as written, and then, if he approves, he should sign the order to give it authority. Without an official signature, no order should be honored. In some plants foremen have so much paper work to do that most of their time is spent at a desk, whereas they should be out in the shop among their men giving suggestions or advice, and checking production.

It should not be assumed that verbal orders and verbal requisitions are satisfactory, because they are not, and they should never be tolerated. Verbal orders cause too much material to be wasted, frequently result in expensive errors, and much time is lost in arguments about what actually was said and what really was needed.

Signed requisitions should balance materials and parts delivered and no machine work should be started without a written order and blueprint or an initialed sketch. The foreman should be very careful to catch any ambiguity, or the possibility of two meanings being taken from any order. For instance; there was the order telephoned in to a brass foundry for bronze castings for a special pump wanted—rush, and it was the foreman himself who phoned it in. There were 32 patterns and the foreman said he was sending them over right away and he wanted 32 castings in bronze from the patterns. The truck driver delivered them to the local foundry who promptly rushed the order through and in three days completed the job and

"I think the men are hinting for a pay increase, Boss."

The

Complete

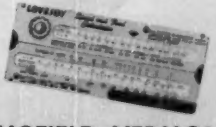
LOVEJOY LINE of Modern Metal Cutting Tools

The Lovejoy line of inserted-tooth type cutting tools has never been more complete—or offered so many features. Every tool has been designed to give maximum production with a minimum of down time for sharpening. Lovejoy tools feature the *exclusive* "Positive-Locking" device that assures rigidity even during heavy intermittent cuts—making them rugged as solid tools. Their housings—of husky forged steel—are designed for longest life.

Lovejoy H. S. S., Carbide and Cast Alloy Blades are interchangeable in the same housing and are stocked for immediate shipment.

For standard or special cutters, call on Lovejoy—suppliers to the world's leading manufacturers for over 35 years. Write today for Catalog No. 28 which describes the full line of Lovejoy tools.

"Speed & Feed Calculator" free on request



128 MAIN ST., SPRINGFIELD, VERMONT

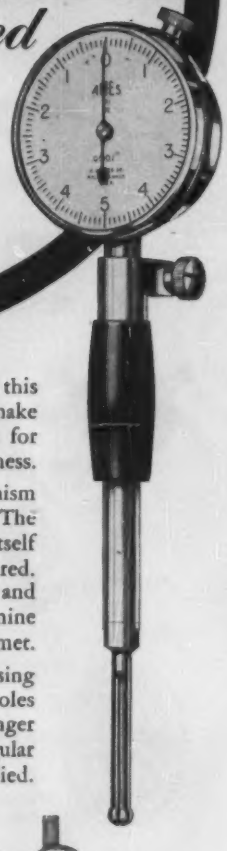
LOVEJOY TOOL COMPANY, INC.

AMES

... the Preferred

FOR FAST, ACCURATE INSPECTIONS

Small Hole Gauge No. 36



Skilled and unskilled employees can use this superbly designed two-point contact gauge to make quick, accurate, *impersonal* inspections of small holes for size, taper and roundness.

The Ames No. 36 has extremely sensitive mechanism especially designed to eliminate "feel" in measuring. The spherical contact point automatically centers itself and indicates the true diameter at the point measured. The operator has only to slide the contact in and around the hole and note the readings to determine if tolerances are being met.

The Ames Small Hole Gauge No. 36, using contacts in increments of 1/32", can check holes of 3/16" to 1" diameter, up to 2" depth. Longer lengths and special contacts to check irregular recesses, splines, etc., can be supplied.

Ames No. 15 Jaw Gauge

Ames No. 13 Dial Comparator

Ames No. 516 Dial Micrometer

Ames No. 25 Pocket Thickness Measure

If you would like to have our recommendations on your measurement problem, send blueprints and specifications. Write for your free copy of catalog on Ames precision measuring instruments.

Representatives in principal cities. B. C. AMES CO. 26 Ames Street, Waltham 54, Mass.

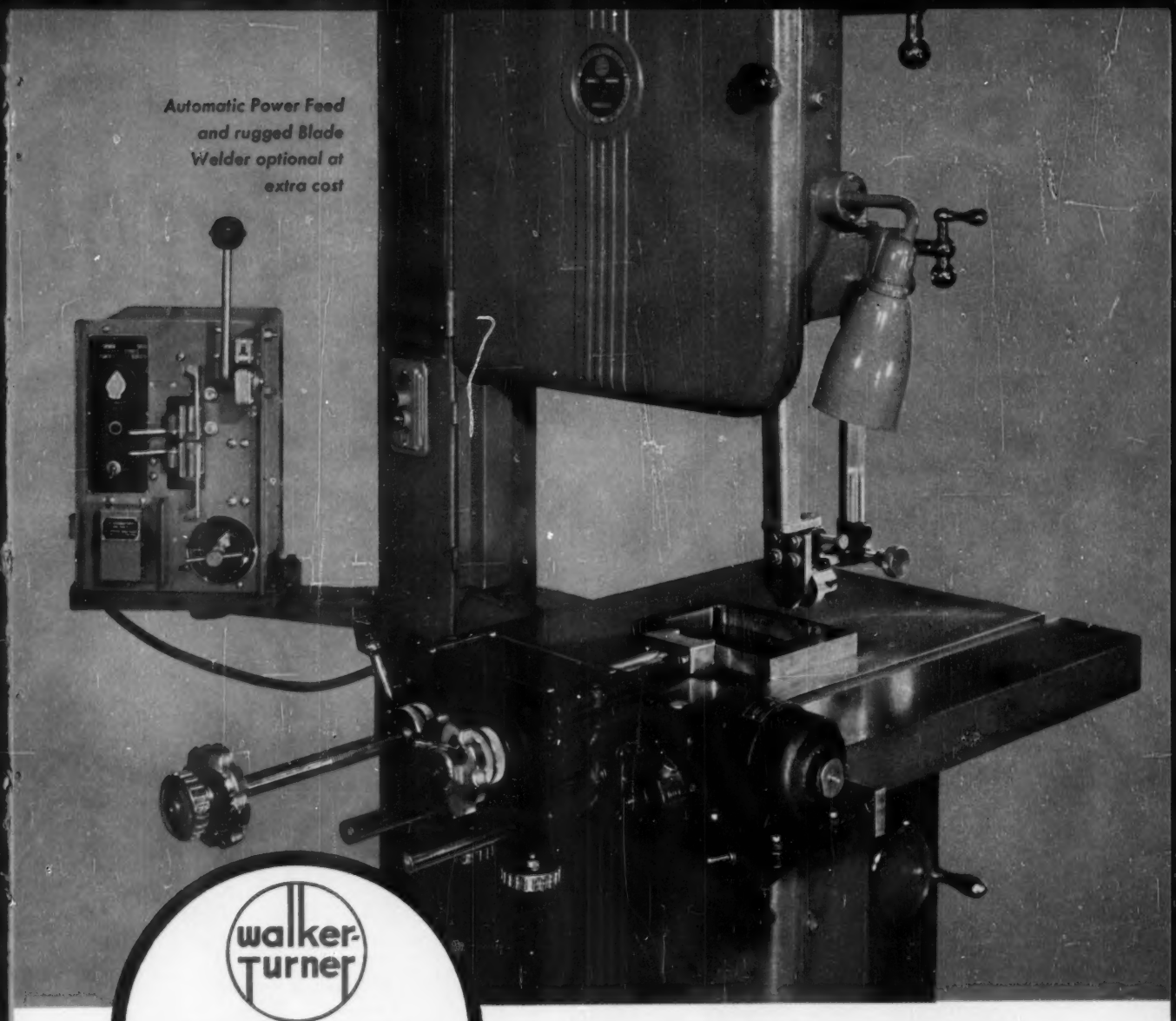
Mfgr. of Micrometer Dial Gauges • Micrometer Dial Indicators

made delivery of 1024 castings or 32 pieces off each pattern. The machine shop lost money since the foundry said the order definitely was for 32 castings from the patterns and that was what they had delivered. If the foreman instead of giving a verbal order had taken a little extra time and had his clerk make out a proper requisition to be delivered with the patterns, then there could have been no misunderstanding and the loss order would have been a profit order instead.

There was the superintendent who hired a painter to repaint the dust collectors, air intakes and other metal work on the factory roof: "Give all the metal work a coat of aluminum paint," was his hurried instructions to the painter and it was very lucky indeed for that man that one of the draftsmen happened to go on the roof to measure for some changes and was just in time to stop him from painting the live, three-phase 24,000 volt power transformer. He had already painted the steel protection fence and had gone inside through the gate, which was kept fastened but not locked, to finish the metal case of the transformer and the caps on the insulators. In this instance a properly tabulated list of the items which were to be painted would have avoided this danger and what might have been a tragic accident would never have been risked.

I know several foremen who always carry a memorandum pad with carbon paper with them and thus keep a copy of all sketches or orders given to their men. If any order gets tangled, the blame can be placed where it belongs, particularly so since all orders or sketches are carefully dated and timed, which is a very important item that sometimes gets neglected.

"Yeah, but it don't say anything about chewing on a butt."



walker-turner

Variable Speed Drive

cuts anything that can be cut

50 TO 4500 SURFACE FEET PER MINUTE

A turn of the handwheel – while the machine is running – sets blade speeds ***in stepless variation from 50 to 450 SFM in low range, or 500 to 4500 SFM in high range.*** Indicator registers exact speed.

The Walker-Turner 16″ Variable Speed Band Saw cuts as you want it to cut. Always on the job, this LIGHT-HEAVYWEIGHT is easily set at exactly the right speed for any stock you work: tough steel…nonferrous metals…plastics…wood. No time lost in belt changes, no efficiency lost because of inadequate speed range. See this versatile precision tool with *Variable Speed Drive* at your Walker-Turner distributor now.

There is much more to this Walker-Turner LIGHT-HEAVYWEIGHT story that our factory-trained distributor in your area would like to tell you. You will find him an expert on industrial equipment, a good man to know. And he's as near as your phone. So why not call him, or write us for his name and more information–today!

WALKER-TURNER

• DIVISION •

KEARNEY AND TRECKER CORPORATION

PLAINFIELD, N. J.

DRILL PRESSES – Hand and Power Feed • RADIAL DRILLS
Wood and Metal Cutting BAND SAWS • TILTING ARBOR SAWS
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No. 123 of a Series of Typical Installations

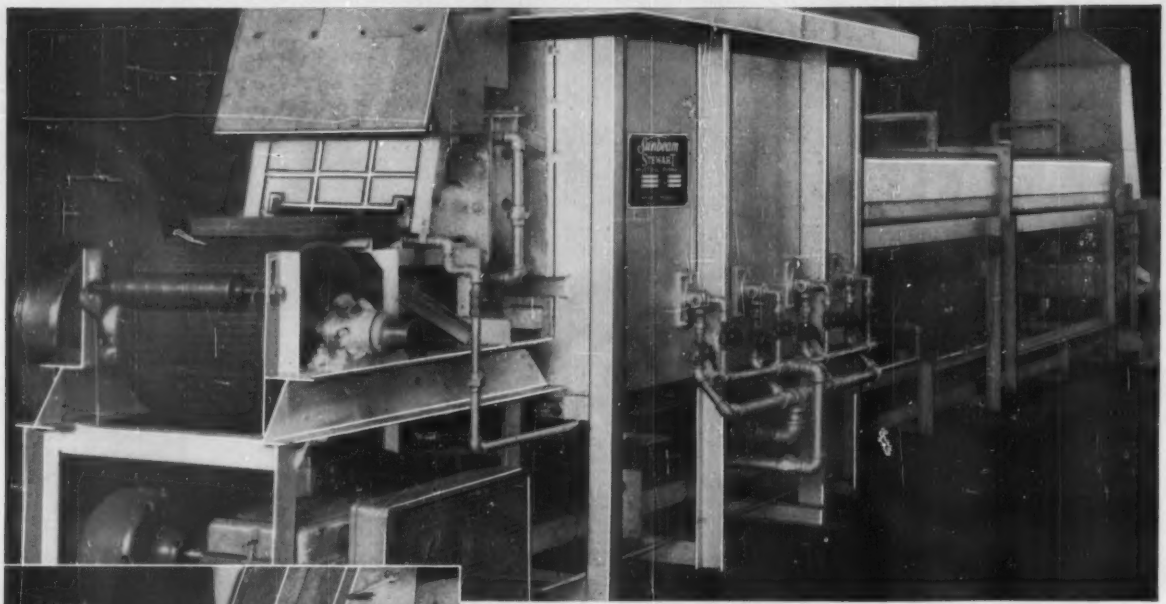
Sunbeam STEWART

THE BEST INDUSTRIAL FURNACES MADE

HOW SUNBEAM FURNACES HELP MANUFACTURERS REDUCE COSTS AND KEEP THEMSELVES COMPETITIVE

ANNEALING GASKETS AND MISCELLANEOUS PARTS

At JOHNS-MANVILLE PRODUCTS CORP.—Goetze Branch, New Brunswick, N. J.



Workman charging the Sunbeam Stewart atmosphere controlled, gas-fired annealing furnace. Full protection against oxidation is provided during both heating and cooling cycles. Temperatures between 800° and 1600° F. can be employed for the various materials.

Charge and side view of the Sunbeam Stewart annealing furnace at Johns-Manville. Being gas-fired, this furnace employs a comparatively low cost fuel with good heating characteristics, fast start-up and good flexibility. Extreme flexibility in operating characteristics allows them to utilize this furnace to process ferrous and non-ferrous alloys.

Based upon their experience with a previously installed Sunbeam Stewart atmosphere-controlled annealing furnace, Johns-Manville added a second identical unit to provide the necessary capacity for increased production requirements. Material handled at Johns-Manville consists of lightweight copper requiring low temperatures, as well as heavy ferrous metal nozzle rings requiring higher temperatures and longer heating cycles. An exothermic cracked gas atmosphere protects work during heat treatment. One generator, located between the furnaces, supplies sufficient atmosphere. It has adequate volume to provide a continuous purging action for both sets of heating and cooling chambers. Each furnace has a maximum capacity of approximately 350 pounds of work per hour, subject to temperatures and materials in process. Sunbeam Stewart full muffle design is ideally suited for atmosphere controlled annealing of both ferrous and non-ferrous material. Products of combustion completely envelope the muffle. The bottom of the muffle is heated partially by radiation from the ceramic hearth. This type of design assures even heating over the entire temperature range of 800° to 1600° F.

For all practical purposes these furnaces are completely automatic and all that is required in their operation is the manual or automatic loading of the conveyor belts. They are suitable for practically all controlled atmosphere annealing where clean results are desired. Other atmospheres, such as endothermic cracked gas, dissociated ammonia, etc., can be adapted for use in this Sunbeam Stewart installation.

MODERN AUTOMATIC HEAT TREAT EQUIPMENT MAY BE THE ANSWER TO YOUR PROBLEM

Sunbeam engineers can help you keep pace with modern production methods. Replacement of obsolete or inefficient heat treating equipment with an automatic Sunbeam installation reduces costs, improves quality, pays for itself in a short time.

Sunbeam CORPORATION (Industrial Furnace Division)

Main Office: **Dept. 119. 4433 W. Ogden Ave., Chicago 23—*New York Office:* 322 W. 48th St., New York 19—*Detroit Office:* 3049 E. Grand Blvd., Detroit 2**
Canada Factory: **321 Weston Rd., Toronto 9**

A letter, wire or 'phone call will promptly bring you information and details on SUNBEAM industrial furnaces, either units for which plans are now ready or units especially designed to meet your needs. Or, if you prefer, a SUNBEAM engineer will be glad to call and discuss your heat treating problems with you.

Written requisitions for materials and parts also save considerable expense because, in general, a man wanting, say some gasket material, is apt to take two or three times the amount he actually needs to be on the safe side if he happens to spoil a gasket; when the job is completed the extra materials are generally thrown back of some cupboard or under a bench rather than returned to the storeroom—and get bawled out by the storekeeper. When the required amount has to be written down on a requisition form, with the foreman's signature, then the workman generally requisitions the minimum amount so the foreman will think the man is trying to help him run the shop economically.

George P Pearce
Albuquerque, NM

YES, THERE ARE some shops that operate almost entirely on verbal orders. I worked for such a firm. What policy we had was a matter of rules and regulation issued by a few who administered them in any way they chose. When this company expanded, general confusion reigned. Someone ordered something and someone else received it. In other cases, one department ordered and another was charged for it. Sometimes you would order supplies, never get them, and then be told you never ordered in the first place. Pretty soon we had to make out a requisition for all supplies. There were three copies, one of which the department retained for his own files. We then knew what was ordered and when. That ended most of the confusion and buck-passing.

Our budget ran month to month on both output and expenditures. Each month we were given a rundown of the coming month's production and the allowed expenditures to do so. When we over-spent we heard about it. If we stayed below, we did not hear anything. After my department ran over the allowed amounts for three months, I asked for, and was granted, an accounting. As I suspected, I was being charged with supplies going somewhere else. From that time on we received an itemized form on all expenditures each month. We then had names, dates, and costs with no more guess-work.

All but the smallest shops need this paper work for successful organization. No one of us can remember word for word a conversation we had yesterday. Just try to remember what you said in the letter you wrote the day before.

A E Salmons
Philadelphia, Pa

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your job is done for you-

when you choose

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COLD FINISHED STEELS
CARBON . . . ALLOY . . . LEADED

✓ ***Precision Dimensions***
✓ ***Precision Cross Section***
✓ ***Pre-finished Surface***

In this age of specialization nothing serves like the highly trained craftsmanship and concentrated experience of the specialist. WYCKOFF has specialized in fine quality cold finished steels . . . rounds, squares, hexagons, special shapes, wide flats and precision shafting. When it comes to cold finished steels in these classifications . . . nothing could be finer.

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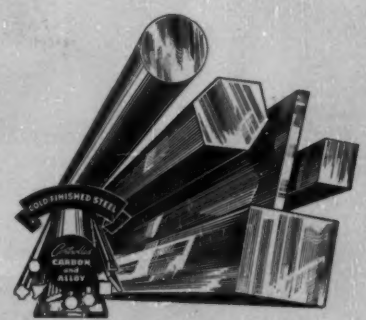
Carbon and Alloy Steels
Turned and Polished Shafting
Turned and Ground Shafting
Wide Flats up to 12" x 2"
All types of furnace treated Steels



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WYCKOFF STEEL COMPANY

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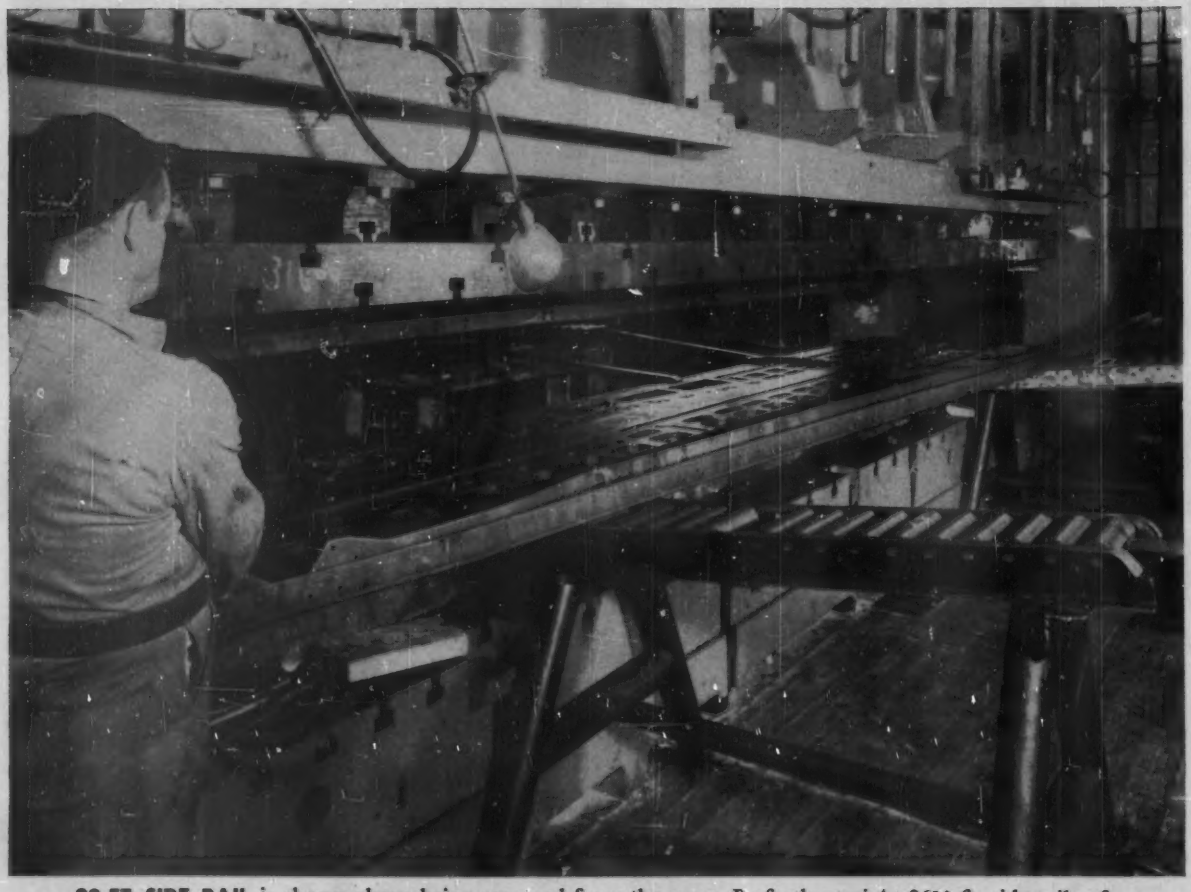
Works: Ambridge, Pa. • Chicago, Ill. • Newark, N. J. • Putnam, Conn.

THE LARGEST MECHANICAL PRESS

New Hamilton 4000 tons capacity press, in which there is no relative deflection in bed and slide, forms side rails that are perfectly straight.



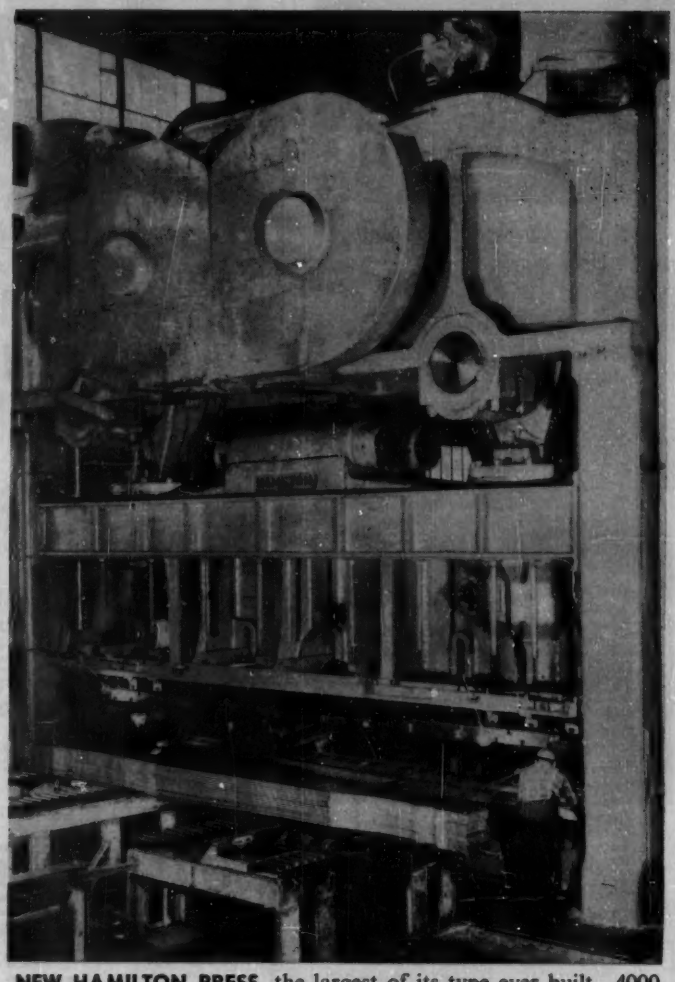
22-FT. SIDE RAIL is shown above being removed from the press. Perfectly straight 26½-ft. side rails of ⅜-in. steel can be formed without camber or "bow." The pressure pad is supported on six air cushions which function as a unit to prevent distortion when the side rail is ejected from the die.

EVER BUILT

This Hamilton Side Rail Press was placed in production last winter in the Cleveland Plant of Midland Steel Products Company. It is an enormous machine, weighing 900 tons, which in itself is newsworthy. However, the outstanding feature is its ability, when loaded to 4000 tons pressure (its nominal capacity) to form perfectly straight side rails, without camber or "bow." This eliminates the subsequent straightening operation which has been the accepted customary practice in chassis frame manufacture.

Other "highlights" of this 4000 ton Hamilton Press

- The bed is equipped with six 42-inch diameter air cushions providing 415 tons pad-pressure with air at 100 psi.
- The cushions are linked together and the operating valves are controlled by one pilot valve so that the six cushions function as a unit at all times.
- Overall height 44 feet with topmost point 30 feet above floor.
- 320 inch clear space between the uprights and gibs; shut height on bed 40 inches.
- Stroke of slide 22 inches; adjustment 12 inches.
- Drive motor 150 hp; slide adjusting motor 25 hp.



NEW HAMILTON PRESS, the largest of its type ever built—4000 tons pressure capacity—is pictured here forming truck chassis side rails 22 ft. long from ¼ in. steel at Midland Steel Products Company, Cleveland, Ohio.

HAMILTON PRESS DIVISION

Baldwin-Lima-Hamilton Corporation

Curtis Building

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Branch Offices: New York • Chicago • Factory: Hamilton, Ohio

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These manufacturers' catalogs are instantly available in Section 5 of your Machine Tool Catalogs:

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Boyer-Schultz Corp.	Norton Company
Bryant Chucking Grinder Company	Oliver Instrument Co.
Crane Packing Company	Reid Bros. Company
	Sheffield Corporation
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ALSO: The following catalogs, in other sections of your Machine Tool Catalogs, contain information on grinding equipment:

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Cincinnati Milling Machine Co.	LeBlond, R. K., Machine Tool Co.
Consolidated Machine Tool Corp.	Ohio Machine Tool Co.
Dake Engine Co.	Osborn Mfg. Co.
Gisholt Machine Co.	Rivett Lathe & Grinder, Inc.
Gleason Works	Rowbottom Machine Co.
Greenlee Bros. & Co.	Sundstrand Machine Tool Co.
Hall Planetary Co.	Torit Mfg. Co.
Jones & Lamson Machine Co.	Wales-Strippit Corp.

In other sections of the File you will find additional catalogs containing useful information on a wide range of machine tools and accessories.

Sweet's Catalog Service

Division of
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TO A MINIMUM WITH A RUTHMAN GUSHER COOLANT PUMP

This Cincinnati Super Service Upright Drill manufactured by the Cincinnati Bickford Tool Co. is equipped with a Gusher Coolant Pump.

Check the features of every Ruthman Gusher Coolant Pump. They assure *you* of absolute minimum maintenance on your Gusher Pumps.

- Totally enclosed drip-proof motors.
- Pre-lubricated heavy-duty ball bearings.
- No packing or priming necessary.
- Electronically balanced rotating assembly to cut vibration to a minimum.
- No metal to metal contact within the pump.

Always specify Gusher Coolant Pumps.

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Supplied in one Superior Accuracy
5 MILLIONTHS ± ACCURACY

34 BLOCK SET (shown)..$125 INCL. OPT. PARALLEL

82 BLOCK SET.....$275 IN CASE

These sets will supply the needs of any discriminating shop that must work to gage-block precision. IMMEDIATE DELIVERY

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$5.00 Extra

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MULTI-PURPOSE PORTABLE UNIT

PRESS to *tap, gauge* or *assemble*—PULL to reverse. Thousands of these compact friction drive machines are finding new uses. Reverses 40% faster. If you hit a hard spot, driving friction slips to warn you to back up, clean away the chips, and make a new start.

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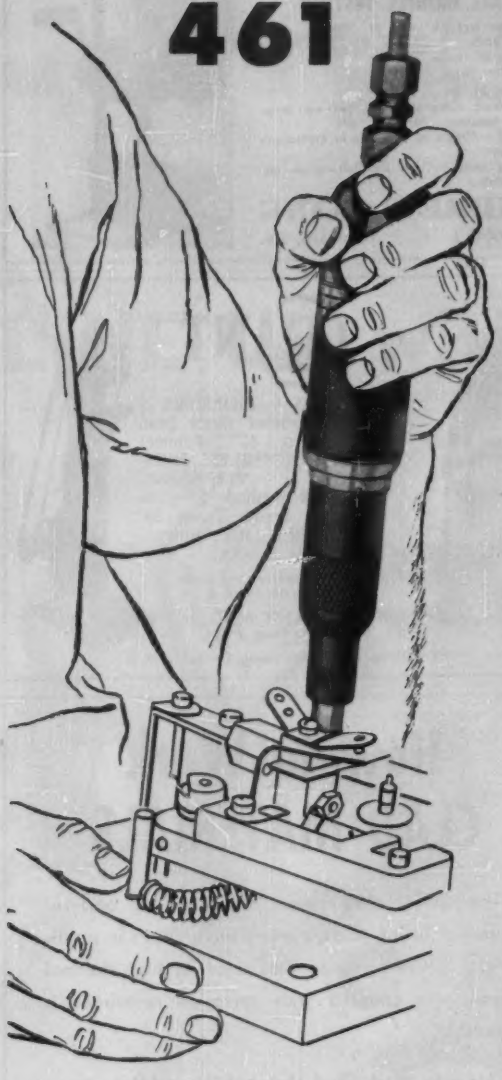
KELLER TOOLS "button up"

461 assemblies an hour

all day long!



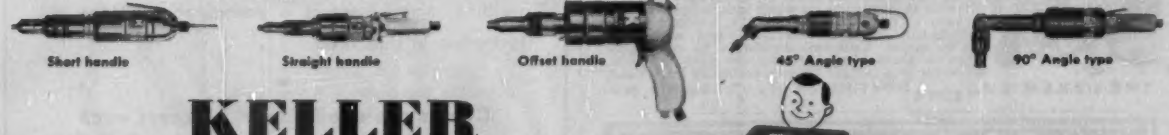
Two workers make a team in assembling parts for automobile horns. Above, the screws are started which attach assemblies of stacked parts to the horn yoke. At left, the two screws are run down and tightened. Both workers use Keller Pneumatic Screw Drivers, and together they assemble at the rate of 461 units per hour.

Sustained high production rates result from providing workers with easy-to-handle Keller Air Tools engineered to the job. Waste motions are eliminated, fatigue is reduced, and production speeds are maintained hour after hour.

Keller application engineers, located in principal cities from coast to coast, have the training, know-how, and experience to select the correct tool for the job. They have a much wider selection of attachments, fittings, pickups, and finders from which to choose . . . plus the backing of design engineers ready and able to provide special adaptations or special tools if needed.

Have you talked to the Keller man, lately?

These are a few of the many Keller Screw Drivers:



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These versatile machines handle an almost *unlimited* variety of work —deburring, filing, lapping, polishing, etc.—on metal and plastic parts. Thousands in use. Production increases up to 158% reported! Many sizes and models. Holding devices to suit the job. *Speed your production with Schauer Speed Lathes.*

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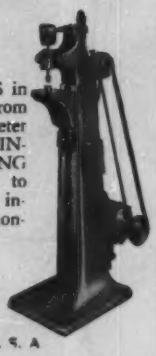

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Lower costs?

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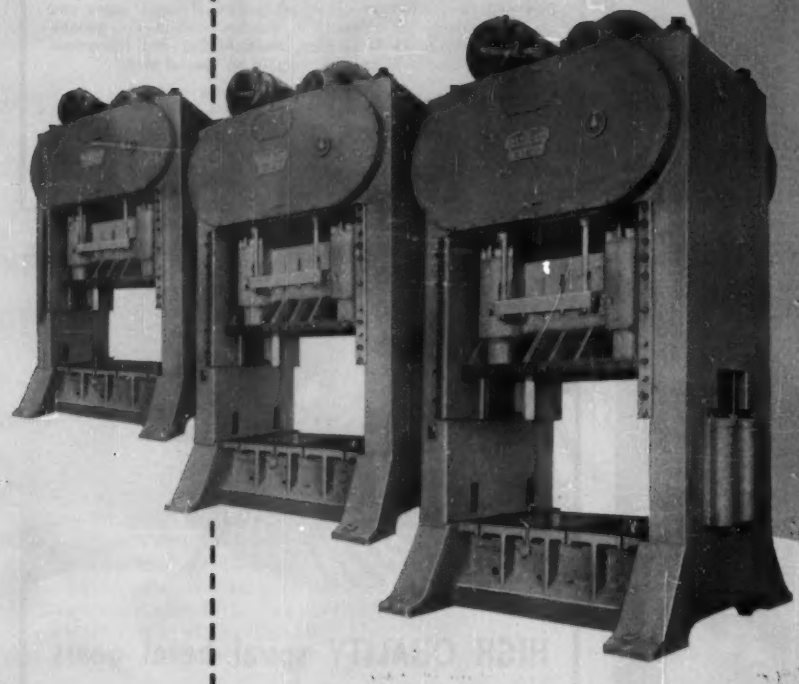

You can easily select the exact type and size press for top efficiency on any stamping job from Cleveland's complete line.

The trouble-free Cleveland Drum Type Clutch gives you positive, instantaneous slide control. Its greater accuracy means fewer rejects. Light-weight and easy to maintain, it cuts press operating costs.

Make your new presses Clevelands. A Cleveland engineer will gladly help you choose the right model Clevelands for economical press production. A-9107

Cleveland 4 Point Presses equipped with Cleveland (Patented) Drum Type Clutch

Stroke of slide	18"
Adjustment slide	12"
Shut height	54"
Bed and slide area	60x84"
Capacity	450 tons

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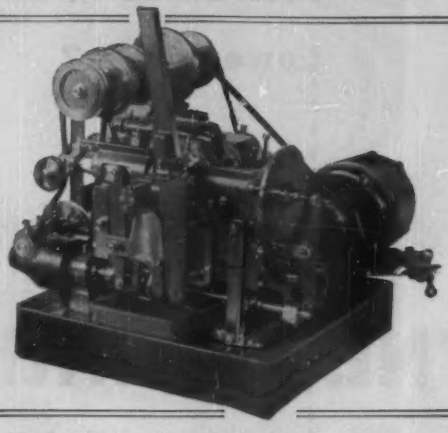

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Always Meet the Specifications

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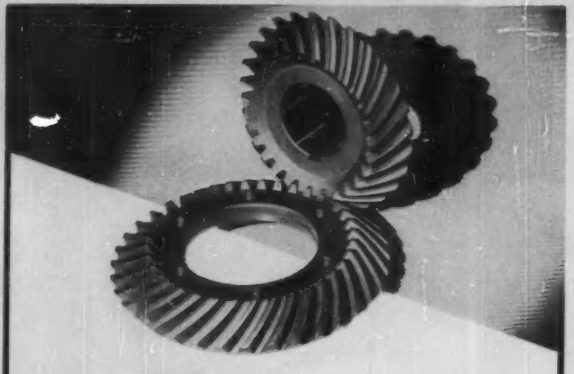

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- Heat treated and lapped in matched sets for high speed operation.
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- Production lots only
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Give Blood Now

CALL YOUR RED CROSS TODAY!

NATIONAL BLOOD PROGRAM

Business Executives!

✓Check These Questions!

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Remember, as long as a *single* pint of blood may mean the difference between life and death for *any* American . . . the need for blood is *urgent!*

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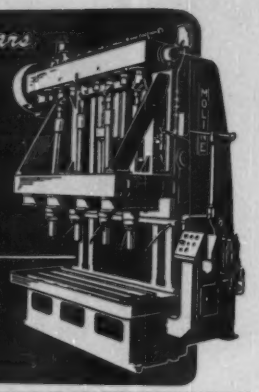

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Bryant *unconditionally guarantees* the flatness and accuracy of all Bryant Granite Surface Plates.

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Gentlemen: Please send me your new free folder describing Bryant Granite Surface Plates

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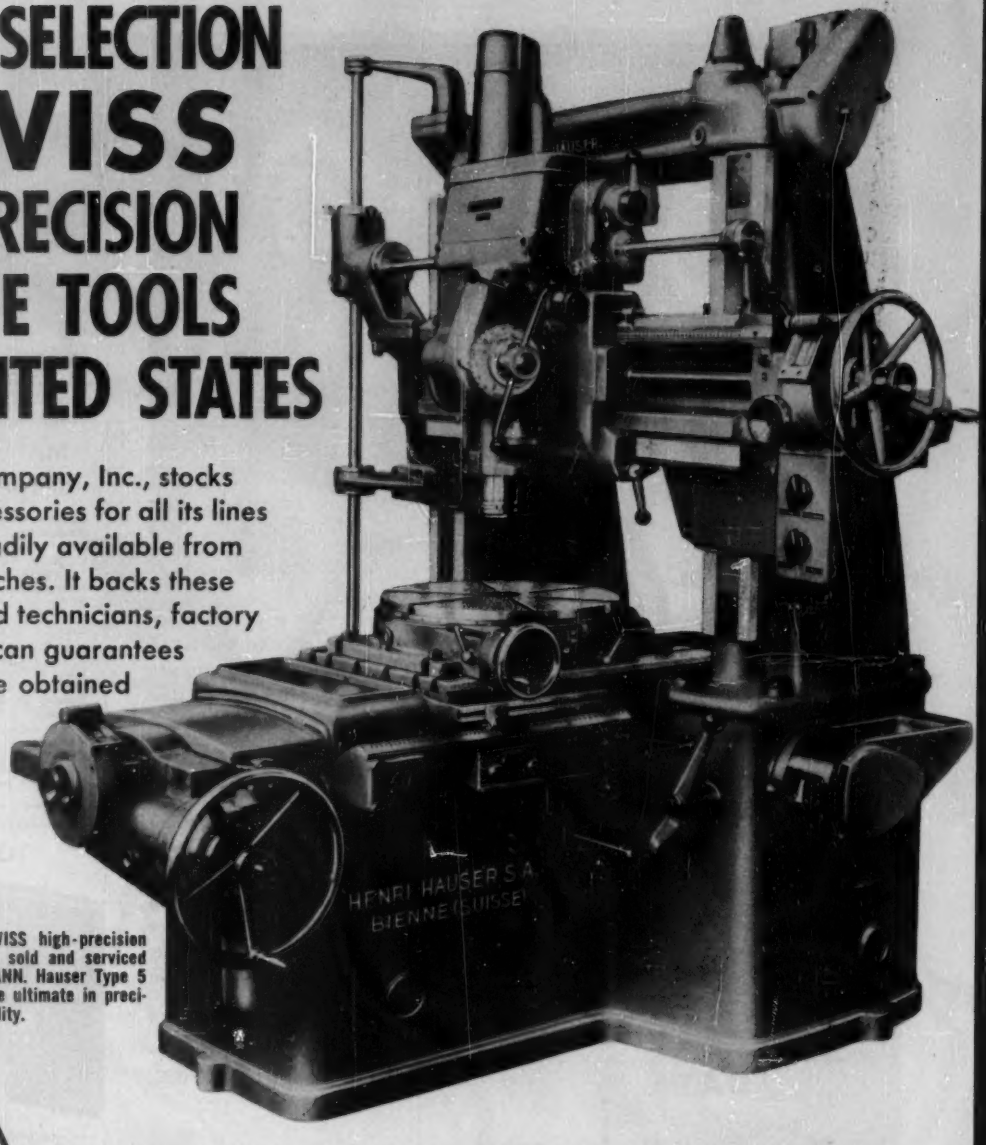

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Largest Selection of SWISS Precision Machine Tools in U.S.

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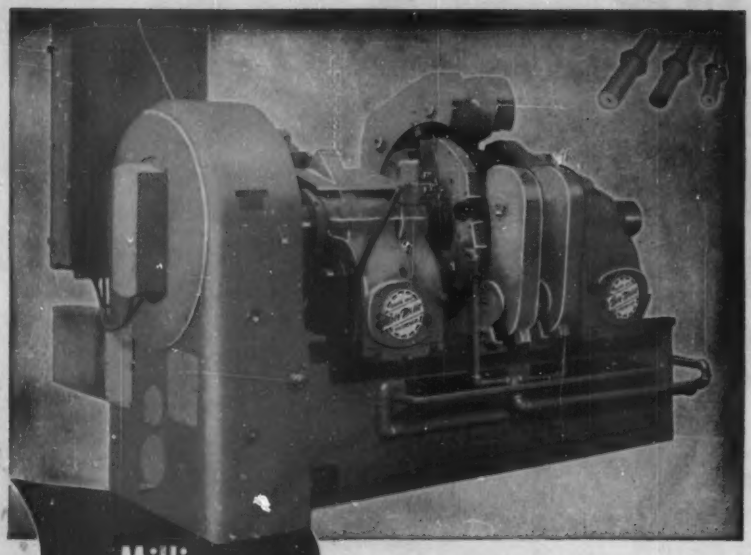

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Here's an excellent example of how two entirely different operations can be combined on one machine. This Davis and Thompson continuous type Roto-Matic both mills and centers on both ends in one operation. Rough and finish milling cuts on the ends of the shaft and centering of both ends is completed with only one rotation of the fixture drum. The centering heads travel with the work station until centering operation is complete then drop back to next work station and repeat. Automatic equalizing clamping is provided to the fixture. Spindles have micrometric adjustment and spindle carriers are adjustable on the ways to accommodate shafts of various lengths.

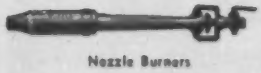
FREE DATA on this and other Davis and Thompson machines is available in our bulletin No. 1000.

Roto-Matic

Davis and Thompson Co.

4460 N. 124th ST. MILWAUKEE 16, WISCONSIN

Ring Burners



Nozzle Burners

Pipe Burners

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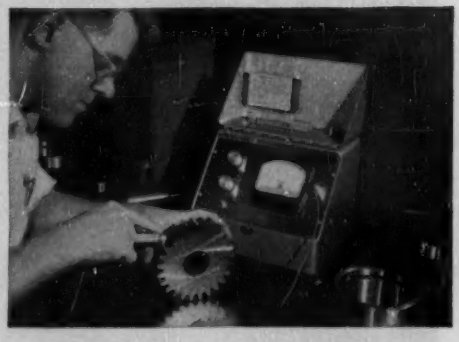

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0	1/2" SS	3/4"–1 1/2"	1/8"
1	1/2" SS	1"–2 1/2"	1/4"
2	2 MT	1 1/2"–3"	1/4"
3	2 MT	2"–3 1/2"	1/2"
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5	4 MT	3"–5"	1"

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Collet Capacity—½"

Spindle Bore—¾"

Swing—9¼" over bed, 3-9/16" over double tool cross slide, 5½" over compound cross slide.

Turret to Spindle Distance—20⅝"

Spindle Speeds—12; 41 to 1270 r.p.m.

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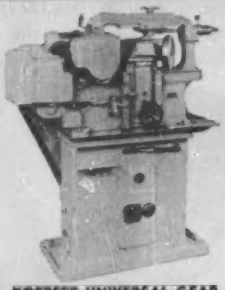

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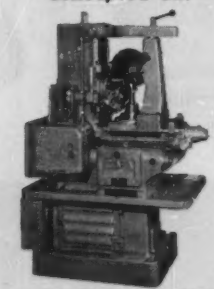

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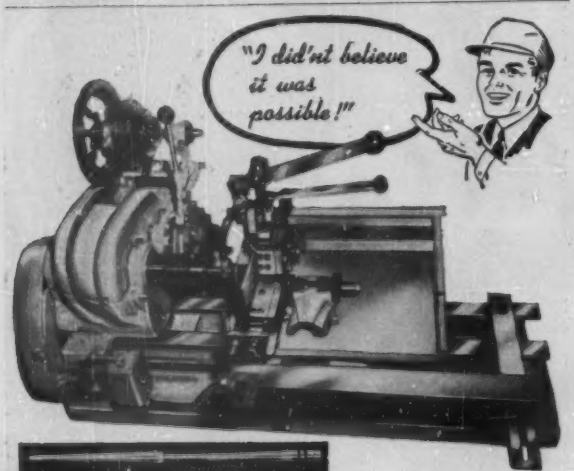

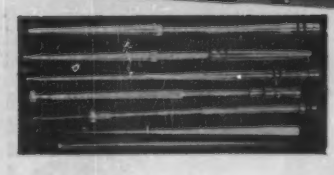

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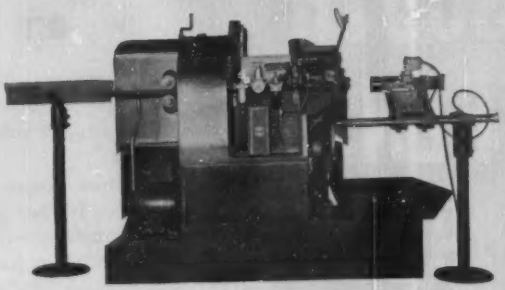

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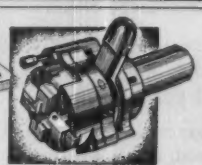

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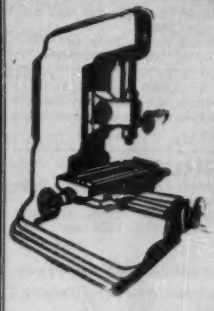

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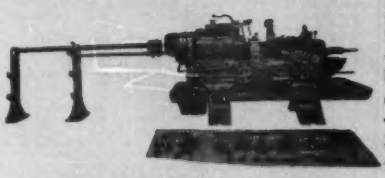


No. 7 BARDONS & OLIVER *Universal Turret Lathe. 2½" capacity. Preselector Head, Late Type.*

No. 00G BROWN & SHARPE High Speed Automatic Screw Machine, Motor Driven, Late type.

No. 1 LaPOINTE Motor Driven Horizontal Broach, 5 tons cap., 38" stroke.

50 HP. CHICAGO PNEUMATIC Air Compresser. Type NSB, 253 CFM, Piston Displacement.

4'x15" Column CINCINNATI-BICKFORD "Super-Service" Radial Drill, Motor on arm, Box table.

No. 262 BARNES Motor Driven Sliding Head Drill Press. 2" cap. in steel.

No. 2 M.T. Six Spindle ALLEN Type KH Drill Press, Individual Motor Drive, Late Type.

6"x18" LANDIS Type "C" M.D. Hydraulic Cylindrical Grinder, Serial #29196.

6"x18" NORTON Vertical and Horizontal Hydraulic Surface Grinder, complete with magnetic chucks, coolant systems, Late Model.

#TG615 JONES & LAMSON Thread Grinder, Late, M.D. and TG848.

No. 208 BESLEY Motor Driven Disc Grinder, 26" wheels, Late Type.

No. 8LS FELLOWS M.D. Gear Lapping Machine. With Detachable Head, Universal Work Support.

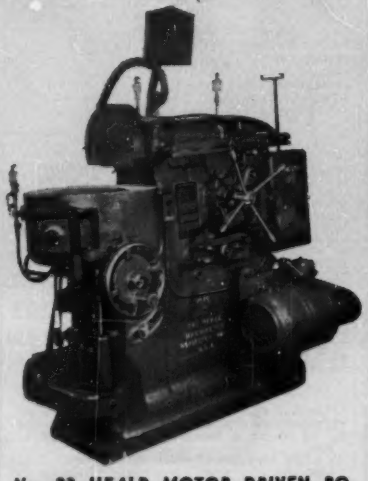
No. 13LS FELLOWS M.D. Gear Lapping Machine, with Detachable Head and Universal Work Support.

20", 24" 28" Gould & Eberhardt V-Ram Shapers, M.D.

No. 194 BARNES Vertical Hone, 4" capacity, 12" stroke, Motor Driven.

30 K.W. LEPEL High Frequency Induction Heater.

16"x54" centers AMERICAN Pacemaker Lathe, Taper Attachment, Late Model.



No. 22 HEALD MOTOR DRIVEN ROTARY SURFACE GRINDER. 12" Magnetic Chuck. Late Model.

20"/27¾"x14' AXELSON Lathe, 115" centers, Taper Attachment, Late.

24"x12' BOYE & EMMES Timken Bearing, Geared Head, Lathe. Late Type.

27"x16' NILES, BEMENT, & POND Geared Head Lathe, 9' centers, M.D.

24", 36" BULLARD Vertical Turret Lathe, New Era, Turret Head, Side Head, Motor Driven.

No. 601 W.D. OSTER Motor Driven Turret Lathe, 1½" capacity, Late.

No. 2, No. 5 WARNER & SWASEY Geared Head Turret Lathes, Bar Feed, Motor Driven.

#2 KEMPSMITH Horiz. Maxi-Mill, Motor in base, Vert. Head.

#08 CINCINNATI Vert. Mill, Plain & Rotary Table Type.

#3B Kearney & Trecker Vertical Milling Machine, Motor in base.

No. 0-8 CINCINNATI Rise & Fall Horiz. Mill, Late Model.

No. 3B KEARNEY & TRECKER Horiz. Mill, Double Overarm, Motor in base.

No. 2M CINCINNATI Universal Horizontal Mill, Full Equipment, M.D.

#M200 DEFIANCE Production Drilling Machine. 2" Cap. in Steel.
#5 M.T., Coolant System. Late Type. 26" Swing, 1942.

No. 5 FEDERAL Open Back Inclinable 4" stroke, Timken Bearing Flywheel, M.D.

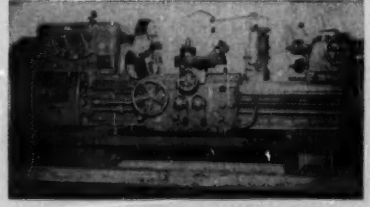
600 ton NILES-BEMENT-POND Motor Driven Wheel Press, 86" between strain rods, 14' capacity, 17" diameter ram.

#5, #7, #8 JOHNSON O.B.I. Presses. 56, 79, 90 tons cap. M.D. Flywheel & Geared Type.

10"x10" RACINE #30-C Hydraulic Heavy Duty Shear Cut Power Hack Saw, 1946.

10'x10 ga., 10'x¼" WYSONG & MILES Power Squaring Shears, Motor Driven.

No. 20, No. 30 WATERBURY FARREL Thread Rollers, ⅜", ½" cap., 1944.



24"x10' AXELSON GEARED HEAD, HEAVY DUTY MODEL "E" 28" ACTUAL SWING, M.D. TAPER ATTACHMENT.

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AUTOMATICS

1-1/16" Cleveland Model A (1942).

BORING MACHINES

No. DB2112 Excello Single End Borer
100" Niles-B-Pond Vert. Bor. Mill.

DRILLS

No. 2 Avey Cam Fd. Drill. 14" Swing.
2 Spdl.—24" SW.—No. 3 Avey
No. 57H Fox 24 Spindle Multiple Drill (1943)

GEAR MACHINES

11" Gleason Gear Generator.
No. 12HS Gould & Eberhardt.
No. 36-BM G. & E.—3 spdl. Rougher.
615-A Fellows Gear Shaper.
612-A Fellows Gear Shaper.
No. 64 Fellows Gear Shaper.

GRINDERS

5"x30" Cam-o-matic (1946).
6"x18" Landis Type C (1942).
6"x18" Norton Type C Plain (1943).
10"x36" Norton Type C Grinder.
10"x36" Norton Type C Cam Grinder.
10"x48" Norton Type C Pl. (1943).
12"x36" Cinn. Universal Grinder
16"x25"x168" Norton Type C (1942)
TG 615 J & L Thrd Gdr.
B—24"-25" Chuck Arter Surf.
No. 1109 Bryant Internal Gdr. (1951).
No. 5 Bryant Internal Grinder.
No. 5B Bryant Internal Grdr.
No. 16-16 Bryant Int. Grinder.
No. 16A-16 Bryant Internal Grinder.
No. 16-28 Bryant Int. Grinder.
No. 16 A-28 Bryant Internal Grinder.
No. 24-26 Bryant Int. Grinder.
No. 24-36 Bryant Internal Grinder.
No. 81 Heald Internal Centerless.
No. 2 MS—16"—2 spdl. Allen Drill

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10"x36" Centers. 14"x36" Centers.
10"x72" Centers. 14"x50" Centers.
10"x96" Centers. 14"x72" Centers.
18"x96" Centers. 14"x96" Centers.
18"-30" gap x 96" Centers.

HONES

Model H-2 Micromatic Horiz. Hone.
Model 200-H5-Dbl. End Micro. Horiz.
Model H-7 Micromatic Vert. Hone

LATHES

R-14 Lo-Swing Automatic Lathe.
18"x6' Am. Geared Head Lathe.
18"x8' Lodge & Shipley Grd. Hd.
27"x12' American Geared Hd. Lathe.
27"x12' centers LeBlond Lathe.
36"x18' Putnam Grd. Hd. M.D.
No. 5W Acme Tur. Lathe (Late).
No. 3AL Glaholt, Cross-Slide Turret.
No. 4A Warney & Swasey Turret.
No. 6 Warner & Swa ey, cone head, Turret.
2¼" x24" Jones & Lamson, turret.
18" Libby, M. D., turret.
No. 4A Warner & Swasey (1944).
No. 4A Warner & Swasey, Taper, Cross-sliding Turret (1942).

PLANERS

48"x36"x14' Gray, 2 Heads.
48"x48"x12' Cincinnati, 2 Heads.
60"x48"x27' American, 4 Heads.

MILLING MACHINES

No. 08 Cincinnati Vert. (1942).
No. 1-12 Cincinnati Pl. Auto.
4" Taylor & Fenn Duplex Spline.
6"x165" Pratt & Whitney Thrd. Mill.
10"x48" Hanson-Whitney Thrd. Mill.
10"x60" Pratt & Whitney Thrd. Mill.
12"x102" Mod. HT Lees Bradner Thrd. Mill.
54"x30"x16' Ingersoll Slab Mill.

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8" 6 Spdl Bullard Mult-Au-Matic
14¾"x19" Fay (Flanders)
20"x25" Fay, timken, new 1942 (2)
20"x32" Fay, serials 80551 & 80557.

COMPRESSORS

275 CFM 10"x10" Union horizontal enclosed
311 CFM 12"x8" Ingersoll Rand air or gas
327 CFM 12"x7½"x12" Ingersoll Rand Imperial type
1400 CFM 21"x15"x16" Worthington Laidlaw horizontal

DRILLS—RADIAL

3½' arm 8" column American sensitive radial
4' arm 13" column Carlton M1B radial, late
8' arm, 3' extension, 16" column American radials, late type (two)

GEAR HOBBERS

No. 3 & No. 12 Barber Colman
Type A Barber Colman universal
No. 12H Heavy Gould & Eberhardt universal
No. 36H Gould & Eberhardt
16" Cincinnati spur and spiral
8"-16" No. 1 Lees Bradner
No. 7S Lees Bradner
No. 3 Adams Farwell
72" S. & S. universal

GEAR MACHINERY MISC.

8" Red Ring Gear Shaver, two, late
8" Red Ring gear lapper
No. 60 Cross gear tooth rounder
Barnes "Mal" Nut O Lap gear lapper
National Cleveland gear checker
100"x24" Newark No. 7 spur gear cutter
10" Pratt & Whitney hydraulic gear grinder
Nos. 71A, 75A, 712 and 715 Fellows high speed gear shapers
Illinois gear measuring machine
No. 343 Sheffield gear chamferer

GRINDERS

72" Hanchett rotary surface, new 1945
10"x36" Landis type DC, cyl. late, hydraulic
14"x36" Landis type C, cyl. hydraulic, late
16"x36" Norton type C, cyl. hydraulic, late
No. 2 Cincinnati centerless, plain and Filmatic bearing
10"x18" Cincinnati Filmatic bearing
10"x18", 18"x36" & 16"x72" Norton cylindrical
12"x36" Cincinnati universal cylindrical, serial 1U-3D-10-5
18"x96" Landis cylindrical
16"x96" Landis cap type cylindrical
No. 120A Gardner opposed spindle disc, 20"
23" No. 84 Gardner opposed spindle disc
53" No. 24A Gardner horizontal disc
30" No. 6 Badger double disc motor on spindle
No. 72A3 Heald plain hydraulic internal
No. 72A3 Heald Gagomatic internal
No. 72A3 Heald Sizomatic internal
No. 5 Bryant internal
5"x18" Norton vert. spindle hydraulic surface
8"x22" No. 3 Abrasive surface
12"x48" Model 300 Hanchett surface
No. 3 Barber Colman hob sharpener
10" Pratt & Whitney hydraulic gear

LATHES

24"x14' bed American GH, QCG, serial 44070
12" Sundstrand Stub lathes (three)
No. 3A Warner & Swasey long bed universal T/L, late
H5 Libby International saddle type universal T/L, Late
Leonard hydraulic tube spinning lathe, new 1947
14"x42" Hendey CamLoc, timken, toolroom
14"x18" Lipe H5 Carbo-lathe, new 1943
17"x6' LeBlond Mfg. timken, (three)
48"x52"x20'6" Niles Bement Pond engine lathe, like new

MILLING MACHINES

1-1B Cincinnati production miller
No. 2L Van Norman universal, vertical head, late
No. 3 Sundstrand Rigidmill production
12" Cincinnati plain manufacturing, also 10"
24"x24"x12' Ingersoll adjustable rail planer type mill. mach., tracer controlled, new 1945
4—3B Cincinnati Hydromatic production
4—4B Cincinnati Hydromatic production
No. 2 Cincinnati high speed dial type plain
No. 1 Milwaukee vertical mill
No. 2B and 3K Milwaukee universal
No. 3B and 4K Kearney & Trecker plain

PRESSES

15 & 25 & 50 Ton Denison hydraulic (4)
56 ton No. 304 Bliss, SS, solid frame, new 1942
60 ton No. 81 Cleveland, OBI (two)
88 ton No. 50-D-36 Cleveland, DC, steel frame
95 ton No. 7 Hamilton, OBI, steel frame (three) new 1947
120 ton No. 306 Bliss, SS, tiered frame
180 No. 94½ E Toledo, DC, tiered frame
500 ton No. 1042 Verson, SS, all steel, air clutch, late model
650 ton No. DA 8411 Hamilton SS, toggle drawing

SHAPERS

16" American
16" American Heavy pattern Auto-oiled
24" Cincinnati Climax heavy duty
26" Morton draw cut shaper
32" G & E shaper

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Hanchett 25 H.P. Sp. Vert. Hydr. Surf. Grinder 12"x48" table.
W & S No. 2-A Grd. Hd. Univ. Turret Lathe chucking.
Rivett No. 184 A.C. M.D. Internal Grinder.
Milwaukee Nos. 2-B & 3-B Horiz. Plain Millers D.O.
Cincinnati 36"x36"x10' D.H. Planer 2 Hds. Box Table.
Heald No. 72A-3 Hydr. Int. Grinder Rod Head Sp.
LeBlond 27"x12' Bed Grd. Hd. Q.C.G. Lathe 15" hollow spindle.
Cincinnati No. 2 HI-Power S.P.D. Vert. Miller.
G & L 9" Bar Horiz. Boring Mill
Barnes 28" All Grd. Camel Back Drill 1-Sp.
Blanchard M.D. Vert. Sp. Surf Grinder 36" chuck.
Campbell No. 213 abrasive cut off 1944.
Sundstrand 4-Sp. Vert. Rigidmill.
Heald #22 Rot. Surf. Grinder 12" chuck 1942.
Landis 2-Sp. 2" Cap. Belt Threader M.D.
Handey 16"x8' bed Q.C.G. Lathe 1939.
W & S No. 4 Ram Type Grd. Hd. Turret Lathe
G & E 24" Gear Box Shaper Tilt. Table Top.
Newton 48" Table 1-Sp. Cont. Vert. Miller.
Foster 2-F Fastermatic Hyd. Turret Lathe.
Kempsmith No. 2 Vertical Maximiller M.D.
Springfield Planer Type Surf. Grinder.
P & J #2 Auto. Prod. Miller, 2 Tables.
Fonte-Hurt #25 Box. Col. 1-Sp. Hvy. Drill.
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Lynd-Farquhar 28" stroke open-side Shaper Planer.

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GG19 Gear Grinding Machine, m.d., latest
GG3I Gear Grinding Machine, Internal Gear & Spline Grinder, m.d.

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Type A Barber-Colman, m.d.
No. 5AC Lees-Bradner Heavy Type Gear Generator, m.d.
No. 12 Barber-Colman Double Overarm, m.d.
No. 12 Barber-Colman Single Overarm, m.d.
No. 34 Brown & Sharpe, m.d.
No. 44 Brown & Sharpe, m.d., Spur & Spiral
Pfauter Gear Hobber, Model RS 1, m.d., new
No. 3 Newark Gear Hobber, Plain Type, md

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18" National Broach & Machine Co
18" Gleason Bevel Gear Tester, md.
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Cincinnati Valve Seat Grinder, cap. ⅝" valve stems, m.d.

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Colburne Mfg. Bench Type Speed Lathe, m.d.
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No. 2 Rockford, m.d.
No. 2H Milwaukee Plain, m.d.
No. 3 Heavy Kearney & Trecker Milwaukee Plain, m.d.
No. 4 Ohio, cone
No. 5 Cincinnati, m.d., late type

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3A Sundstrand Copy Rigidmill, m.d.
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24" Cincinnati Duplex Automatic, m.d.
24" Garvin Cam or Form Milling Machine, m.d.
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Norton 12" x 36" Hydraulic Universal—Internal spindle—MD—Late type

MILLERS

Milwaukee #3K Plain—Range 34" x 12" x 16"—Table 64" x 14"—#50 taper—Speeds to 1500 RPM—MD—Late type

Cincinnati #4 Plain—Rectangular overarm—Timken bearings—#50 taper—Power rapid traverse—MD—Vertical head

Van Norman #26 Plain—Table 12" x 56"—Range 28" x 12" x 19"—#50 taper—Coolant—MD—Late type

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36"x12' centers AMERICAN Heavy Duty 16 Speed Geared Head Lathe, AC-MD

80"x20' NILES-BEMENT-POND Geared Head Engine Lathe, rapid traverse

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No. 1A WARNER & SWASEY Universal Turret Lathe, Timken spindle, electric chuck

No. 2A WARNER & SWASEY Universal Turret Lathe, preselector head, bar feed, chuck, new 1943

No. 3A WARNER & SWASEY Turret Lathe, Timken spindle, electric chuck, tooling

No. 3 WARNER & SWASEY Universal Turret Lathe, 800,000 series

No. 2 VAN NORMAN Plain Horizontal Mill, New 1943

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No. 4 CINCINNATI High Speed Dial Type Plain Horizontal Mill, new 1942

No. 4 CINCINNATI High Power Dial Type Vertical Mill, 25 HP motor, new 1951

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42" KING Vertical Boring Mill, 10HP AC motor, power rapid traverse.

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MACHINERY FOR SALE

4—#1A Warner and Swasey lathes

4—#2A Warner and Swasey lathes

1—#4 Warner and Swasey lathe

2—#5 Warner and Swasey lathes

Excellent condition—presently being used in precision production—can be inspected.

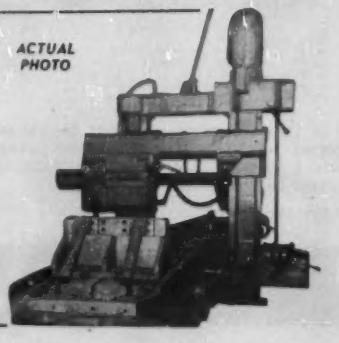
FS-2001, American Machinist

330 W. 42nd St., New York 36, N. Y.

NEW 1945 INGERSOLL SLAB OR STRADDLE MILL 24" x 24" x 12'

Rise and fall, rapid traverse, complete tracing control, quick change speeds and feeds, tubular ways, anti-friction bearings, all electrical equipment, automatic cycling, coolant system.

ACTUAL PHOTO



MILES MACHINERY COMPANY

2039 Genesee Ave., Saginaw, Mich.

MACHINERY FOR SALE

ATTENTION EXPORTERS

Unusual opportunity to procure modern Fellows Gear Shapers 615A and 645 as well as 12" Gleason Generators, 36 BM Gould & Eberhardt Rougher #7 Fellows Gear Shaper, #16 D. E. Whiton Machine. Write for full information.

FS-1638, AMERICAN MACHINIST
330 W. 42 St., New York 36, N. Y.

Don't forget the

BOX NUMBER

When answering the classified advertisements in this magazine, don't forget to put the box number on your envelope. It's our only means of identifying the advertisement you are answering.

1941-1954 MACHINE TOOLS

CUTTER & TOOL GRINDERS
FELLOWS: Flat Top Helical Gear Cutter Grinder
OLIVER: 10" Template Tool Bit

DRILLING MACHINES
ALLEN: No. 2 Drill—6 Spindle, 8" overhang
ALLEN: #2 High Speed 15"
BARNES: No. 210, 2-spindle, 21" Swing
PRATT & WHITNEY: ½B x 50 Deep Hole Drilling & Reaming Machine, 2-spindle
RADIAL DRILLS: Archdale, 5', 6' & 7', new

GEAR MACHINERY
FELLOWS: 61A & 64A Shaper, 18" dia.
FELLOWS: Flat Top Helical Gear Cutter Grinder
FELLOWS: Straight Line Generator, 3" dia. with many cutters
GLEASON: #12 Rough & Finish Gen.
SYKES: Rack Cutting Machine 12" to 36" length capacity (New)
PRATT & WHITNEY: Gear Grinder, 10" single and double wheel, hydraulic feed
GEAR GRIND MACH: GG-19, 10"x24" Hydr. Spur Gears and Splines
INTERNAL GEAR GRINDER, GG-31

GEAR TESTERS
FELLOWS: 8 LSI and 13 LSI Gear Lappers, external and internal spur and helical
FELLOWS: #12C Cone & Spacing Inspection Instrument
GLEASON: No. 3 Bevel Gear Tester
GLEASON No. 4 and No. 6 Bevel Gear Testers. Hand and Power
NATIONAL BROACH: SIC-12" Red Ring Gear Testing Machine

GEAR HOBBERS
REINECKER 60"
BROWN & SHARPE No. 44 20" cap.
SCHUCHARDT & SCHUTTE, 36" cap.
LEES-BRADNER 49A

GRINDERS—CYLINDRICAL
BROWN & SHARPE: No. 10 cap. 6"x18" plain
CINCINNATI, 6"x18" Hydraulic, Plain
LANDIS: 16x32" Type "D" Crankpin, hydraulic, for grinding crankshafts
NORTON: 12"x18" Type C, Universal
NORTON: 10"x36", 30 Deg. Angle Wheel
NORTON: 10"x18" 45° angle wheel

GRINDERS—GEAR & SPLINE
GEAR GRIND MACH.: GG-19, 10"x24" Hydr. Spur Gears and Splines
PRATT & WHITNEY: 10" single and double wheel, hydraulic feed
INTERNAL GEAR GRINDER, GG-31

GRINDERS—INTERNAL
BRYANT: 16-16 Internal Hydraulic
HEALD: #50 Planetary

GRINDERS—RADIUS
VAN NORMAN: #73, capacity 7½"
VAN NORMAN: #649-16, cap. 6" to 16" dia
VAN NORMAN: #3½ Un. Radius

GRINDERS—THREAD
EXCELLO: #31 External, dia. 5"x18"

HONING MACHINES
BARNES: Model 172, 7" stroke.
MICROMATIC: H-510 Double End Horizontal, ¾" to 2" dia.
MICROMATIC: H-2 Single End Horizontal, 2 spindle, ¼" to 1" dia.

LAPPING MACHINES
FELLOWS: 8 LSI and 13 LSI Gear Lappers, external and internal spur and helical

LATHES—PRODUCTION
BLOUNT: Polishing speed lathe 12" dia. x 48" centers
LODGE & SHIPLEY: #3A Duomatic, 25½" swing x 27" centers

LATHES—TURRET
BULLARD: 36" Vertical turret
WARNER & SWASEY: #1A, #2A, #3A & #4A

LATHES—TURRET—*continued*
WARNER & SWASEY: #3, #4 & #5
HERBERT: #0, #2, #4, #7, #8 and #9B/30 Sizes, new
WEBSTER & BENNETT: Vertical Turret Lathes 36" & 48" (New)

MILLING MACHINES
TAYLOR-FENN: M-80 Duplex Spline
RICE-BARTON: 4" Twin Spline
VAN NORMAN: 10CT Contour Miller, horizontal opposed spindle type for milling flat cams, also can be converted to similar work

SAWS & CUT-OFF MACHINES
RUSSELL: 9½" cut-off Saw with Auto. Stock Feed (New) Hydraulic
RUSSELL: 5½" dia. cut-off saws, auto stock feed, hydraulic (New)
MOTCH & MERRYWEATHER: No. 3 Circular Saw with auto. stock feed

THREAD MILLERS & TAPPERS
HALL PLANETARY: Mod "D" Thread Miller
LANDIS: 2½" single head horiz. threading machine
LEES-BRADNER: #40A Thread Miller
LEES-BRADNER: CT-36 Thread Miller chucking type, 13¼" hole
MURCHEY: #22 Horizontal threading and tapping machine, ½" to ½" dia. capacity, single spindle

MISCELLANEOUS
MOLDING MACHINES, ROLLER JOLT: Osborne Model 2047-3
AUTOMATIC SCREW MACHINE, Wickman, Single Spindle, 7/16" New
RACK CUTTING MACHINE: Sykes 12" to 36" length capacity (New)
CUT-OFF: Russell 5½ & 9½" cut-off saws with auto. stock feed (new) hydraulic
TEST STAND: Denison 918-AM Hyd.
HARDNESS TESTER: Grogan Brinell, 16-8
SHEFFIELD Precisionaire Gauge
SUNDSTRAND: Double-End, #53, 42" & 60" Centering Mach.
WIRE FORMING MACHINES: 4-slides (new)

TRIPLEX MACHINE TOOL CORP. ESTABLISHED 1919

75A West Street, New York 6, New York — **Cable Address TRIMACTOOL**

SPECIAL OFFERINGS from MACDELL

Each machine unconditionally guaranteed

★ GISHOLT 1S Dynetric Balancer Rebuilt 1944.

★ GISHOLT 3S Dynetric Balancer Rebuilt 1945.

★ CINCINNATI GILBERT 3½" Floor Type, Boring Bar, 1942.

★ CINCINNATI No. 3 Centerless Grinder, Filmatic, 1943.

★ SCHMALTZ 30"x48" Hydraulic Cylindrical Grinder, 1938.

★ CLEVELAND 36"x36"x8' Openside Planer, 1945.

★ KEARNEY AND TRECKER 3H Plain Horizontal Mill 1941.

MacDell
CORPORATION

1042 W. Lake St., Chicago 7, Ill.

Tel: MOnroe 6-7715

LATE TYPE MACHINE TOOLS

48" Jungenthal Vertical Turret Lathe. New.
650 Ton Verson Double Action Eccentric Press. 1940.
No. 41 Lucas Horizontal Boring Mill. 1941.
DB-215A Excello Double End Borematic. 1945
HP-100 LaPointe Horizontal Hydraulic Broach 1945.
12" Gleason Gear Generator. 1942.
No. 7 Gleason "Revex" Gear Rougher. 1943.
16"x72" Norton Univ. Grinder. 1942
TG 6"x36" Jones & Lamson Thread Grinder 1943.
No. 3S Excello Precision Thread Grinder.
24-36 Bryant Hydraulic Internal Grinder. 1947
No. 72A3 Heald Plain Hydraulic Internal Grinder. 1941.
No. 24D Mattison (Hanchett Type) Duplex Grinder. 1945
No. 10 Sundstrand Automatic Lathe F & R Slides. 1942.
No. 6DRE Potter & Johnston Automatic. Late.
No. H5 Libby Universal Saddle Type Turret Lathe. 1939.
No. 3R Gisholt Universal Saddle Type Turret Lathe. 1942.
No. M-18 Kearney & Trecker Simplex Mill 1943.

Write for Complete Stock List

Indianapolis
MACHINERY & SUPPLY CO.
1961 SOUTH MERIDIAN STREET
INDIANAPOLIS 6, INDIANA

"LOOK THESE OVER"

No. 45 HEALD Boromatic, Single End, Two Spindle
10x20 MONARCH Model EE Toolmaker's Lathe
12x30" MONARCH Geared Head Lathes
14x40 CARDIFF Gap Bed Lathes
30"x16' bed AMERICAN High Duty Geared Head Lathe
36"x17' AMERICAN Heavy Duty Geared Head Lathe, 1941
42"x15' AMERICAN Heavy Duty Lathe
42"x25' centers AMERICAN Heavy Duty Lathe
60"x18' LeBLOND Heavy Duty Geared Head Lathe New 1952.
Nos. 5A and 5Y BRYANT Internal Grinders
No. 18 BLANCHARD Vertical Rotary Surface Grinder
10x36 HILL CLARKE Plain Cylindrical Grinder
No. 172 HEALD Gap Internal Grinding Machine for large swing
10"x72" LANDIS Type C Hydraulic Plain Grinder —1942
24"x276" LANDIS Type B Hydraulic Pl. Grinder
42" BULLARD "Spiral Drive" Vert. Turret Lathe.
Nos. 4D and 6S POTTER & JOHNSTON Automatic Lathes.
1L GISHOLT Universal Turret Lathe, 1946.
No. 8A JONES & LAMSON Saddle Type Universal Heavy Duty Turret Lathes.
No. 2 CINCINNATI HS Dial Type Plain Millers.
No. 0-8 CINCINNATI Plain Milling Machines.
No. 2M CINCINNATI Vertical Miller, 1941.
FITCHBURG Plain Horizontal Mfg. Type Milling Machine, 24"x72" table.
No. 1-18 CINCINNATI Plain Mfg. Miller.
No. 3B BROWN & SHARPE Dual Control Plain Miller
No. 5 CINCINNATI High Power Plain Miller with motorized overarm
6"x60" P&W Model C Thread Miller
E-5 & 2AL NATCO Multiple Spindle Drilling Machine
Nos. 64 and 72 FELLOWS High Speed Gear Shapers
No. 12 FELLOWS Gear Shaver, 1943.
No. 36BM GOULD & EBERHARDT Gear Rougher
16/20" GOULD & EBERHARDT Industrial Shaper
36" OHIO "DREADNAUGHT" H.D. Shaper
100" BETTS Vertical Boring Mill, 2 heads.
CINCINNATI BICKFORD Precision Drilling Machine with Bullard Man-au-Trol Table.

WIGGLESWORTH INDUSTRIAL CORPORATION

203 Bent St. Cambridge 41, Mass.

MOST DIVERSIFIED STOCK IN THE U. S.

POWER PRESSES all types, 1-1000 ton
POWER PRESS BRAKES & POWER SHEARS
WIRE WORKING MACHINERY, Wire Drawing, Straightening and Cutting 4-Slide Wire Forming Machines
ROLLING MILLS, SLITTING MACHINES
BOLT & NUT MACHINERY
ROLL FORMING MACHINES
MACHINE TOOLS

"If it's machinery; we have it."

NATIONAL MACHINERY EXCHANGE
138 Mott St., N. Y. CAnal 6-2470

HYDRAULIC PRESSES REPAIRED AND REBUILT

Complete line of new presses available including: "C" Frame Presses up to 100 tons; Hobbing Presses up to 2,000 tons; Up and Down-Acting Presses up to 600 tons; Hydraulic Power Units up to 10,000 P.S.I.

Write for illustrated 38-page catalog.

"C" Frame Press Model #11, 10-ton capacity

CLIFTON HYDRAULIC PRESS CO.
290 Alwood Rd.
Clifton, New Jersey

2 HYDRAULIC COPYING LATHES

HEAVY DUTY TOOL ROOM AND PRODUCTION MACHINES
18"-20" SWING, 60" CENTERS

New Condition—Used for Display Only
Can Be Purchased at Reduced Prices

BOX AM 1282
221 West 41st St., New York

No. 2 B & S High Speed Autos. M.D.
No. 25 Heald Rotary Surface Grinder.
P & W 30" Vert. 2-spindle Profiler.
Peerless 6½ x 6½ Hack Saw, hyd.

D. E. DONY MACHINERY CO.
4357 St. Paul Blvd., Rochester 17, N. Y.

BARNES H-4 HYDRAM
NEW — In Original Crate
Priced For Immediate Sale
ARNOLD HUGHES CO.
765 Penobscot Bldg., Detroit 2, Mich.

LATHE

One heavy duty Putman Lathe, with quick change, 18 foot centers and 20 inch swing. *Completely re-conditioned.*

BREHM BROS.
4th & San Fernando Sts., San Jose 13, Calif.

FOR SALE

1—Heald Sizematic, completely rebuilt by the Heald Machine Company within the last 6 months, serial No. 6887.

FS-8821, AMERICAN MACHINIST
330 W. 42nd St., New York 36, N. Y.

These advertisements

are current, live opportunities in the metal-working field.

Each advertisement represents a current Want or Offering of an organization or individual in this field, with some element of profit in each for whoever can fill the need. Some have money-saving possibilities, others are opportunities for more business; many are employment opportunities; still others offer property, or equipment used or surplus new equipment. "Searchlight" advertisements are constantly changing. New opportunities are finding their way into this great Want medium each issue. Regular consultation of the "Searchlight" pages can be as important to you as reading the text pages of each issue; Text matter is news of progress and development in the industry, "Searchlight" advertising is news of current "Opportunities" in this industry.

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AARON • NEW—USED REBUILT MACHINE TOOLS • IMMEDIATE DELIVERY

AUTOMATICS
Brown & Sharpe (1) Model #4
Brown & Sharpe (1) Model 2G, 1¼" capacity.
Brown & Sharpe (8) Model 0G, ⅝" capacity.
Brown & Sharpe (4) Model 00G, ⅜" capacity.
Ceco Screw Machine ¾" capacity.
Cleveland Model AA-11. Model B.
Cleveland 1½", Conomatic 4 Sp.

BORING MILLS
Bullard 24" V.T.L. Spiral Drive
Bullard 8"—8 spindle, Multi-Matic
Cleveland 2½" Bar Capacity, Defiance 3¾" Bar
Giddings & Lewis #32, 3", #25, 2½" Bar
Kings 42", 72" Vertical 2 rail heads
Niles-Bement-Pond 4" 41½" Bar, 60" Vert.
Ohio 5" Bar. Universal 3"

DRILLS AND RADIALS
American 6'x15" Universal, 4'13", 3'9"
Baker No. 321 Vertical Boring & Drill
Buffalo #2 Motor Spindle, #16—4 Sp.
Buffalo: Power No. 41, No. 42 RPMSTERS
Cincinnati Bickford 6'15" col. 3'9"
Natco #12, 20 spindle. Model B2A—10 Sp.
Leland-Gifford 2 LMS, 3MS
Leland Gifford No. 2—4 Sp.

ENGRAVERS
Gorton #ME, 1D, 3Z, Deckel G1L, G1, G2
Gorton Graduating Mod. #687-1
Preiss UAM. New 3 Dimensional
Taylor-Hobson 3 dimensional Pantograph

GRINDERS, MISCELLANEOUS
Brown & Sharpe #2 Universal 14"x28", #3 Univ.
Brown & Sharpe #5, 3"x18" Cylindrical
Brown & Sharpe #13 Universal Tool & Cutter
Cincinnati 6x18" Hyd. #4—Centerless—#2
Douglas Tool & Cutter 8"x15"
Gardner Disc Grinder 30"—15 H.P. Motor
Heald 72A3 Int. Centerless Sizematic
J. & L. Thread; TG615, Lempco 54" Swing
Landis 6"x30" Type C Cyl., 10x24 Univ. 12x30
Norton #2 Tool & Cutter, No. 1 Tool & Cutter
Norton Type C 6"x18" Semi-Automatic cyl.

GRINDERS, SURFACE
New 9x24" Hyd. Feed 10x8", 6x18
Abrasive 8x24", #32 Vert. & #34
Brown & Sharpe #5, #2 with Chuck
Gallmeyer & Livingston—65
Heald 22—12" chuck, Arter 12", Coval No. 15
Norton 6x18 Hyd. #15 Covel Hand.
Portman 12" Chuck Rotary
Pratt & Whitney 12x36" Vertical
Thompson 6x18

GEAR EQUIPMENT
Barber Colman #18 Hob Grinder
Barber-Colman Mod. SHS, Sharpener
Barber-Colman #3, #2, #12 (3) also Type S
Fellows High Speed Shapers 712, 725, 71, 7, 61A
Gleason Gear Rougher, Gleason #6 Power Tester
Gleason #2 Surface Hardener, No. 3 Gear Tester
Gleason #3 Spiral, #3 Straight Bevel
Mikron No. 79 Gear Hobbers
Michigan Univ. Hob & Cutter Relieving

LATHES
American 12"x30", Bridgeford 36"x20", 32"x16'
Cincinnati 22"x10'
Gisholt Simplimatic 18"x16½", 2 Tables
Hendey 12"x42 and 12x30", 16x160"
LeBlond Regal 10"x3' bed, 13x42", 17" Late type
LeBlond 25/50x96" Gap, Late type.
Lodge & Shipley #3A, Duomatics
Pratt & Whitney 16"x60, 10"x20", 16"x36
Monarch Magna-matic 14"x54", 20"x48"
Rivett Model 918 Precision. Mod. 715
Putnam, Sliding Gap 22"/46"x92"
Sebastian 14"x6", So. Bend 13"x42", 14"x28"
South Bend 13"x5' Q.C.G., 10"x3½ Taper Att.
Sundstrand 8x15", 15' Stub

HYDRAULIC EQUIPMENT
Injection Molders, Pumps, Presses 125 to 800 Tons. Accumulators, Hobbing Presses, Etc.

Completely Engineered by a Competent Staff

MILLS, VERTICAL
Cincinnati (2)—1-18 Plain Automatic
Cincinnati #3, 08 Vertical
Gorton 8D Super Speed
Milwaukee 4K & 2K
Morey #12M Profiler, 2 sp. #2 Maximiller
Reed Prentice Vert. Mill & Die Sinker Mod. 3VG

MILLS, PLAIN, UNIV. PROD.
Brown & Sharpe #0 Omniversal, #000 Production
Brown & Sharpe #2B Plain, No. 2, 3A, 2?, #2L
Cinn. 08 Rise & Fall, 2-24 Automatic
Cinn. #3, 4 Plain, #18 Mfg. #5-48 Hydro.
Kent Owens IV, 1-B, 1-14, 1M, 2-20
Milwaukee 2H Universal, 2H Plain
Milwaukee #2B, Plain & Univ.
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(8) Van Norman #12—Hor/vart—Late

PRESSES
Bliss 650 Hi-Production Presses
Bliss 18, 19, 21, OBI, 58, 62, 162, OB
Bliss #78½, 330 Ton SS, Bliss 74½
Bliss 5-48 Dbl. 32x48" bed, Cushion
Hamilton 850 Ton S.S. Bed 27x48
Hamilton 110 FM Die Tryout Press
New 85, 60, 55, 30, 20, 15, 10, 5 Ton O.B.I.
Stokes Tablet Presses, Mod. R, RD3, RD35, DDS.
Thomas 56 Ton O.B.I.
Walsh No. 3 O.B.I. 23 Ton, LI #3
Z & H #4½, O.B.I. 20 Ton, 36-6 Back Gear

TURRET LATHES
Bardons & Oliver #2, 3, 7 Bar Feed
Gisholt 2L, Cross Slid. Tur. & Hard.nge DSM-39
Gisholt #5, Bar Feed, Plenty of Tools
Gisholt 4R—9¼" hole in spindles
Jones & Lamson, Mod. 8A, No. 5
Warner & Swasey #1, 1A, 2, 2A, 3, 3A, 4, 5

MISCELLANEOUS
Band Saw: New Kalamazoo & Johnson
Bending Roll: Reed-Power 5", 48"—8 ga.
Bolt & Pipe Threader: Landis, Oster-Williams
Broach: New 6 Ton Horizontal, 11 Ton Vertical
Hacksaw: Peerless 6"x6", Racine 6"x6", Marvel #9

This is but a partial listing. Hundreds of others in stock.

AARON MACHINERY CO., Inc., 45 Crosby Street, New York, 12, N. Y.

"CABLE—AARMACH N. Y." — *Rental & Time Payments* — **Telephone WOrth 4-8233**

#2 NORTON UNIV. TOOL & CUTTER GRINDER, 1942, Hydraulic, Well Equipped.
Price $2,450.00

#2 CAM HASKINS TAPPER, Ser. #T21352, Equipped with air indexing fixture, ¾" Cap. in brass.
Price $650.00

Numerous Other Machine Tools

CURRIER MACHINE SALES
376 State St., P.O. Box 292
North Haven, Conn.

HD MACHINE TOOLS

Serving the World's Largest Manufacturers

NEW - USED REBUILT MACHINERY

5'9" MORRIS MOR-SPEED RADIAL DRILL
#5 B&S Cylindrical Grinders, Late
20"x10' Bed L&S Model E Selective Head Engine Lathe —Serial #29286
#5 Late Type Gisholt Turret Lathe—Serial #848-38
No. 47 Heald Single End Borematic — Serial #4646
22"-44"x80" Bed Putnam Sliding Bed Gap Lathe

MONA MEMBER

HAZARD BROWNELL MACHINE TOOLS INC.
350 WATERMAN STREET — PROVIDENCE 6, R. I. — DEXTER 1-8880

BENNETT MACHINERY CO.

GUARANTEED MACHINE TOOLS

AUTOMATICS, 1⅞" 6 Spin. Cosmatic
BORING MILLS, 42" King, Side Hd., New 1942
42" Bullard, Spiral Drive
72" King, P.R.T., M.D.
100" & 72" N.B.P., 2 hds., M.D.
3¼" bar Defiance, Table (2)
8" Bar Niles, Floor type
RADIAL DRILLS, 5'15" col. Amer., Motor-on-Arm
4'13" col. Cinci. Bickford, M.-on-arm
GRINDER, 16"x96" Landis Hyd., Late
24"x168" Cen. Norton "G", 1943.
LATHES, 48"x20' & 24' beds Niles (2)
20"x32"x168" Cen. American Pacemaker
14"x80" cen. Amer., T.A.
SHAPERS, 32, 28", 20", 16" & 14", G. & E.
SLOTTERS, 20"-24" & 12" Dill-Lobdells

375 Allwood Rd., Clifton, New Jersey
Phone: PRescott 9-8196 — N. Y. Phone: LOngacre 3-1222

54" BULLARD V.T.L., 1944
32" AMERICAN LATHE, 108" ctrs., 1944
MEDART BAR TURNER, 6" cap., 1945

HEAVY PLATE SHEARS
10'x1" cap., 10'x⅝" & 12'x⅜"

BRANDT MACHINERY CO.
514 Empire Bldg., Pittsburgh 22, Pa.

MACHINERY FOR SALE

Brown and Sharpe Hobber, No. 44, serial No. 104 with Crocker Wheeler Motor, serial No. 748275. Equipped to cut spur and spiral gears and splines.

Schuchardt and Schutte Hobber, 36" CAP TP #2, serial No. 6706. Equipped with diffcrential for cutting spur, spiral, and worm gears.

60" Reinecker Hobber, RF No. 4N, Serial No. 6937/1. Completely rebuilt. Equipped with Tangential feed and differential.

These hobbers now being used in production and in excellent condition. Can be seen in operation.

1—Monarch Lathe 12" and serial No. CK 3919.

1—Monarch Lathe 14", serial No. C-5239.

All of the above equipment motorized, 220 volts AC, 3 phase.

FS-8480, AMERICAN MACHINIST
330 W. 42 St., New York 36, N. Y.

WANT TO TRADE

The following 3 machines for 12x72" or 14x72" standard make EXTERNAL GRINDER. Also need a Natco Multiple Drill Press. Must be recent models and in excellent condition. Advise what credit you would give us on trade-in basis.

36" Schuchardt Hobber, Serial #6706—in excellent working condition. Maintains gear hobbing within .0006 tolerance and up to 36" diameter.

Brown & Sharpe #44 Hobber, Serial #104—in good working condition. Can hob up to 12" in diameter. Equipped for spur, helical & spline work.

Landis EXTERNAL GRINDER—10x48" Type DC. Serial #30186—in excellent condition.

Advise make, serial number, condition and full particulars.

T-2315, AMERICAN MACHINIST
330 W. 42nd St., New York 36, N. Y.

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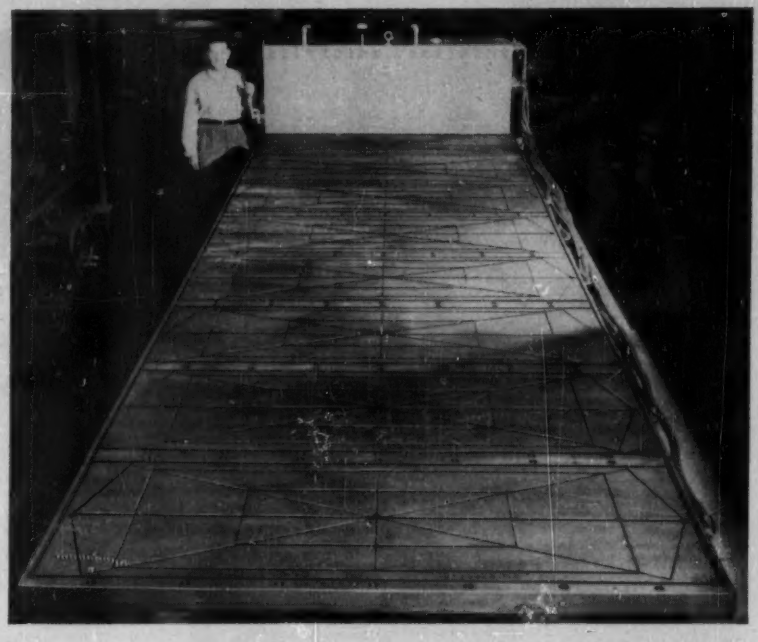

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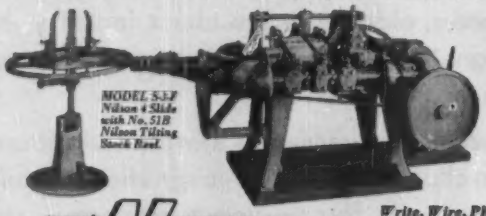

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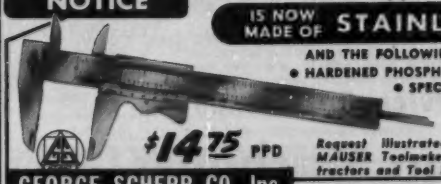

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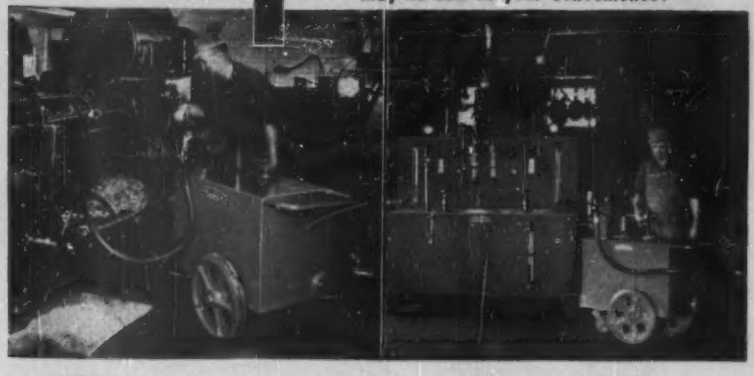

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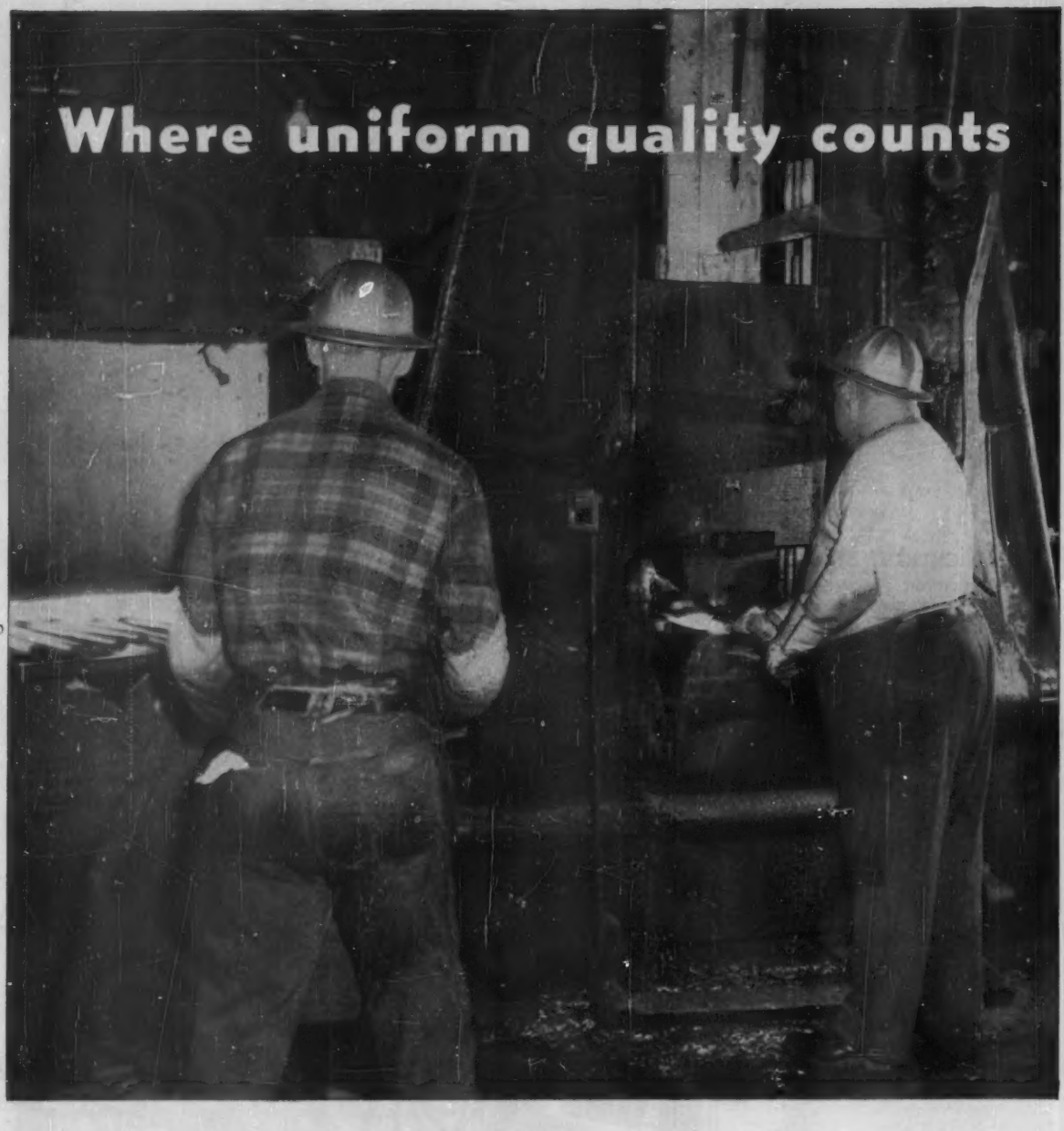

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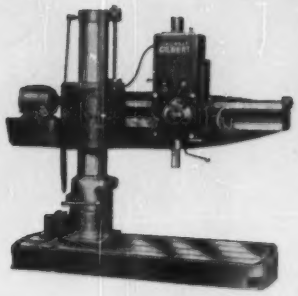

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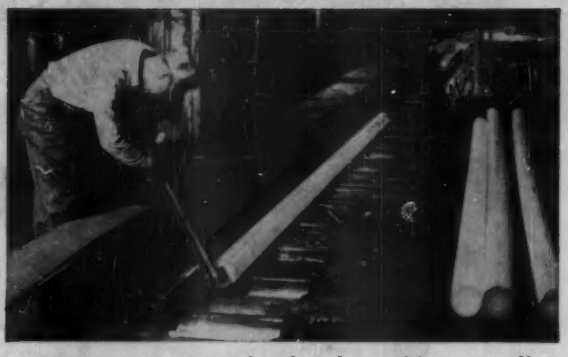

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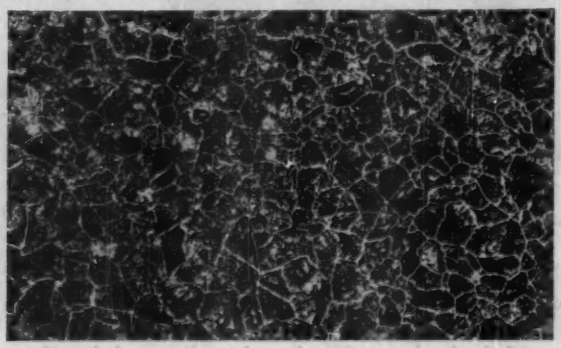

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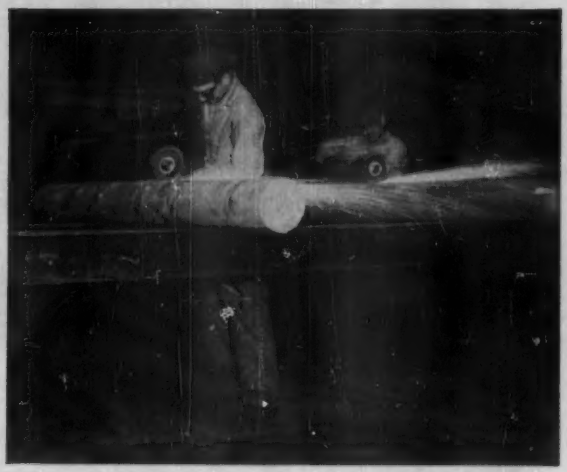

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